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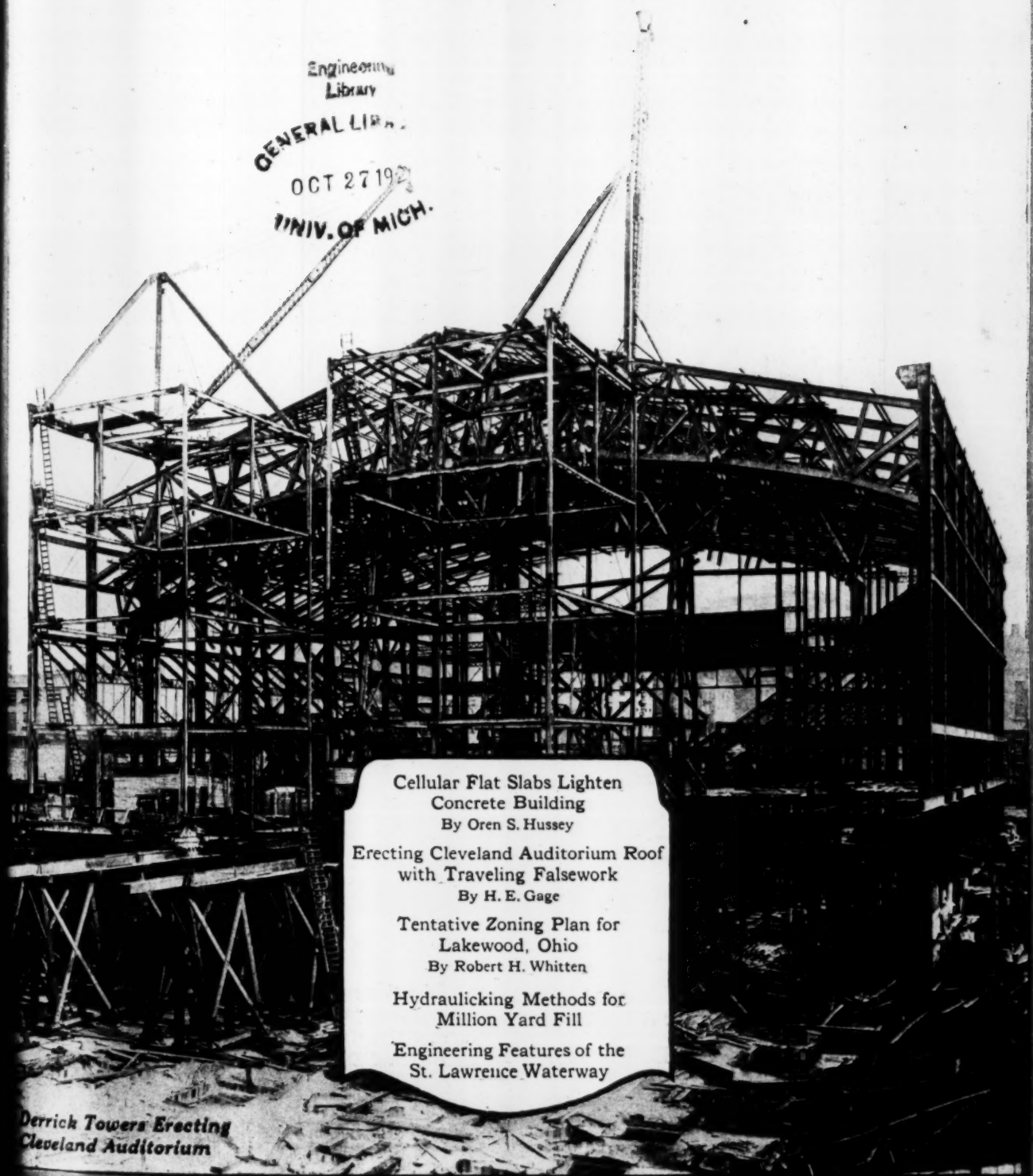

Cellular Flat Slabs Lighten Concrete Building
By Oren S. Hussey

Erecting Cleveland Auditorium Roof with Traveling Falsework
By H. E. Gage

Tentative Zoning Plan for Lakewood, Ohio
By Robert H. Whitten

Hydraulicking Methods for Million Yard Fill

Engineering Features of the St. Lawrence Waterway

Derrick Towers Erecting Cleveland Auditorium

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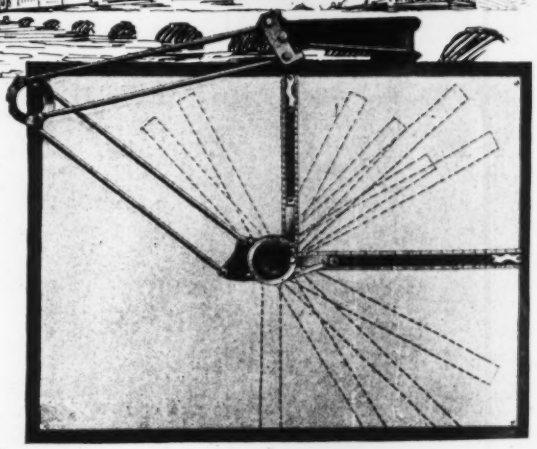

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN
Editor

Volume 85 — NEW YORK, THURSDAY, OCTOBER 21, 1920 — Number 17

British Miners' Strike

THE BRITISH MINERS, contrary to expectations, have gone on strike. Two postponements, at the request of the Government, raised high the hope that there would be a peaceful settlement. Now 1,000,000 men have laid down their tools, and England faces the greatest peace-time crisis in her history. If continued but a few days (this is written on Monday afternoon) factories must shut down and transportation will probably be seriously curtailed. As to the outcome of this trouble, there seems to be no doubt whatever in well-informed British quarters. The Government has confidence that the Nation approves its course of not making the concessions demanded by the men. It believes that the inconvenience will be tolerated, and that the preparations it has made will prevent, for as long a time as the strike can last, hardship due to failure of the food supply. With its habitual calmness the people have watched the struggle coming on and the actual conflict is entered, according to the Manchester *Guardian*, with surprisingly little heat on both sides. This temper is an admirable one and gives hope that the men themselves, recognizing the calm attitude of the public, with its evident desire to be fair, will listen to the counsel of their leaders and return to work before the crisis produces the acute suffering that is inevitable with its long continuance. This much is certain—the British public will not allow the strike to be the instrument for nationalizing the mines, the original object of the union's leaders.

Earth Shrinkage Research

NEED for further experiments in determination of the final change in volume of earth from excavation to embankment was shown in the article by E. E. R. Tratman in *Engineering News-Record* of June 24, 1920. Since that time the subject has been under discussion in various published communications, and an article presenting the results of a study from measurement records, made by a sub-committee of the railroad presidents' conference committee on valuation, was published in the issue of Aug. 26, 1920. Definite progress in earth-shrinkage research is shown in the recent "density" tests conducted by the valuation department of the Chicago, Burlington & Quincy R.R., as reported elsewhere in this issue. Here, a relation appears to have been established between the amount of shrinkage and the depth of excavation below the surface. In this connection it is interesting to note the recent experience of an Eastern road. It allowed 10 per cent for shrinkage in building a yard embankment with material taken from deep excavation. But after a prolonged wait the material had not shrunk 10 per cent and it was necessary to remove some of it in order to bring the embankment down to grade. Further research is important not only for valuation but also for location and construction purposes.

Sand Fills for Factory Sites

HYDRAULIC FILLS of pure lake sand have been specified in recent operations of reclaiming low lands for factory sites on the shores of Lake Michigan. The artificial plateau which lifts the enormous Field Museum building at Chicago some 30 ft. above the lake shore represents the beginning of this practice but more truly characteristic examples are furnished by the fill at Waukegan, Ill., described on another page, and a simultaneous and almost equally as large an operation at Muskegon, Mich. Prevalence of sand beaches and inshore dune lands affords the opportunity for choosing sand and makes the choice economical, but the practice is also based on other considerations. The sand fill is clean and sanitary and its surface drainage is as nearly perfect as can be. A more important advantage is that the moment the sand is hydraulically deposited it attains its final settlement and solidity. Foundation construction can proceed at once, without fear of internal readjustments of the supporting earth. Moreover, as indicated by the operation described, some rather remarkable hydraulic-dredging records are being made in handling these large volumes of sand.

Cost-Plus for Public Works

FOLLOWING the rejection of bids opened April 27, 1920, for the construction of the Wanaque earth dam of the North Jersey District Water Supply Commission the contract is being readvertised with important changes. Originally there was provision for a readjustment of prices, during the progress of the work, based on a rise or decline in the cost of labor (see *Engineering News-Record*, April 8, p. 734). Even this stipulation, decidedly radical for this class of contract, did not have the desired effect of securing either a sufficiently large number of bidders or prices low enough, in the judgment of the Commission's engineering advisers, to justify an award. The particular feature of the new contract, for which bids close Oct. 28, is the inclusion of two forms of proposal, the first involving a type of cost-plus-percentage fee and the second a straight unit price. While the cost-plus feature was widely used in war contracts and has always been more or less common in private work, its adoption now for a public works project is worthy of note. Under the cost-plus form for the Wanaque dam the work is divided into various items, and prices have been determined and made public by the commission's engineer for which it is estimated that unit quantities of the respective items can be constructed or furnished. Upon the estimated cost of the work, as thus obtained, the contractor bids his percentage compensation fee. There is also a sliding scale feature of the payment clause whereby the contractor's percentage, if the actual cost exceeds the estimated or "base" price, is reduced; or increased, on the other hand, if he succeeds in doing the work at a lower figure than that set by the engineer. The cost

of the work now to be placed under contract, exclusive of the percentage fee on the chief items, is $1,384,150. The low bid on the previous occasion of opening bids, reduced to terms of the present project (which has been reduced in size from that originally advertised) was about $1,790,000. The latter figure, of course, included contractor's profit. The occasion of opening bids next week on the revised contract, therefore, will be interesting from the point of view of determining whether the new cost-plus feature will result in more bidders and lower prices.

What Will the American Society of Civil Engineers Do With Its Proceedings?

WITH the August number the American Society of Civil Engineers made important changes in its *Proceedings* and invited views on proposals even more far reaching. These changes and proposals needed immediate consideration, but it was idle to expect it while the constitutional amendments were under discussion. Now the time is more propitious.

The changes already made were put into effect without consulting the members, and the publication committee has authority to proceed with the others when it sees fit. It is apparent, therefore, that the committee considers them purely administrative in character. In this view, evidently, the board of direction concurred, for it is not conceivable that the board would endorse anything, without consulting the membership, that it considered ran counter to the essential service of the society.

The changes and proposals, however, are such a marked departure from past practice that an examination of them in the light of the society's purpose is called for. In fact, such an inquiry is demanded by the uncertainty displayed by the publication committee itself. Possessed with the full authority of the board to make additional changes, it hesitates to use its authority until it has heard from the members. It apparently doubts its own conclusions, even after it has convinced the board of their soundness and secured for them the board's approval.

The society's object is "the advancement of engineering knowledge and practice, and the maintenance of a high professional standard among its members." While there have been suggestions as to new methods of accomplishing this purpose, and even of broadening it by emphasizing the society's civic duty, there has never been a desire to divert the society from its original and constitutionally expressed object. The attainment of that object has been sought, principally, by discrimination in admitting members, by the presentation and discussion of technical papers, and by committee work.

Keeping the object in mind, we direct our attention to the new measures.

All of them are put forward as part of a program of economy, in response to a resolution of the board directing the committee to report a plan whereby savings may be made in the publications. As a matter of fact, some of the changes and proposals actually call for greater expenditures. The committee's suggestions, therefore, fall into two classes—those that make for economy and those that make for expansion.

The "economy" features include the reduction of margins and the omission of papers, of discussions, and of the new-book and current-engineering-literature sections. Merely a synopsis of the papers is to be printed in *Proceedings*. The papers in full, the discussions and the two sections are to be sent only to those who request them, but each member is to receive the *Transactions*, made up as heretofore—with the papers and discussions in full.

Of these changes the most important, obviously, is the omission of papers and discussions, and this, as well as the other changes and proposals, the committee has handled as a matter of mere administration. But is it a mere detail when viewed in the light of the society's object, "the advancement of engineering knowledge and practice"?

To advance an art is no small task, and in its accomplishment every step needs to be taken to overcome natural human indifference. Instead of helping to secure for the society's papers maximum attention by making them easy of access, the committee's plan places a hurdle in the way. We cannot believe that the papers will get so good attention under the new plan as under the old, nor that the discussions will be followed so assiduously. If that view be correct, the new scheme hits directly at the society's progress along one of its chosen lines.

From this standpoint, too, the proposal of the acting secretary that the papers and discussions be printed as formerly and that the *Proceedings* be collected from members to be bound merits consideration. It has obvious difficulties. The task of collection would be tremendous, and the collation of the discussion on a given paper immediately following the paper itself would be well-nigh impossible. Modifications can be suggested. Each member, for example, might be allowed to look after his own binding, albeit he would get less from the society for his dues by the value of a paper binding of *Transactions*. Further, the issuance of all discussion in a single pamphlet to be bound with the *Proceedings* already in the members' hands would at least result in putting all of the discussion on a given paper in one place, though not following the paper itself.

Before dismissing the "economy" measures, it is not out of place to ask why, if economy was in mind, the committee did not apply its pruning knife to the department carried for some time in the *Proceedings*, entitled "Items of Interest." It is formless, without policy or plan, and ran, in the August number, to twenty pages. Evidently the committee fails to distinguish between the function of "advancing" engineering knowledge and "disseminating" engineering knowledge. "Items of Interest" disseminate, but do little or nothing toward "advancing" engineering knowledge. Some of the items are necessary matters of news, but very many of them have no place in any scheme that fits into the object as expressed by the society's constitution.

We come now to the second element of the plan—that of expansion. This element, too, is the more important, even though the announcement, while asking questions on certain of its features, did not segregate it and thus direct toward it the attention it deserves.

The proposal, reduced to a sentence, involves the abandonment of the publication of a "proceedings" and the substitution therefor of a magazine. "Announcements" are to give way to journalistically treated sections, entitled "Society Affairs" and "Activities of Local Sections." A correspondence department is to be inaugurated in which will be discussed not merely

society matters and "general developments in engineering," but also "topics of passing importance to the profession." The only papers to be printed are "short, timely papers of wide general interest." The introduction of editorial comment, of a section on engineering research, and of employment notices is being considered, while the publication committee has authority to increase the page size to 9 x 12 in.—the standard magazine size—and to insert advertising. These proposals, combined with the "Items of Interest," previously referred to, complete the project of making a magazine for the members of the society.

Obviously, some of these things are desirable. The flatness of *Proceedings* in the past has been deplorable. There is need for the journalistic treatment proposed for society affairs and the activities of local sections, but obviously the relief of this flatness does not necessitate editorial comment—nor correspondence on "topics of passing importance to the profession"—nor an increase in page size—nor the taking of advertising. All of these things are part of the scheme of making a magazine. The argument that has brought the committee to this conclusion probably runs something like this:

We must secure revenue. Revenue can be secured from advertising. Advertising can be secured most easily for a paper that is read. To be read a paper must be interesting. To be interesting it must be varied and not too heavy. Therefore to get revenue we will make a magazine that is varied and not too heavy.

The chain of reasoning might go unchallenged in a purposeless organization, but with a body established for definite purposes—pursued with devotion for sixty-eight years—the argument must be examined in connection with those purposes.

The blunt question is whether the publication of a magazine fits in with the object of "advancing engineering knowledge and practice," or is an alien activity. Certainly, a "proceedings" on the old order, with some obvious improvements in presentation, did serve that object. The form of magazine now planned by the publication committee, however, is directed chiefly at the "dissemination" of engineering knowledge, rather than its advancement through the focusing of serious engineering thought on the technical problems confronting the profession. The committee's drift is apparent not merely from the character of the "Items of Interest" now published in the *Proceedings*, but also from its invitation to the members to submit letters on "topics of passing importance to the profession," and its conclusion to print in the *Proceedings* only "short, timely papers of wide general interest."

The incompatability of magazine publishing with the conduct of a society appears at many points. Take, for example, the matter of editorial comment. Whose opinion shall be expressed? We have in the past been treated to sharp conflicts even on technical matters which, it would appear on the surface, could be settled by a clear presentation of "facts." For the best accomplishment of the society's object a judicial habit of mind and a calm course are desirable—something that will not be encouraged if the society decides to take editorial positions, with the certainty of ensuing controversy.

The incompatability appears also in the matter of advertising. Is there not a fine distinction conferred by aloofness from commercial considerations, a distinction inseparable from high professional standing? We believe that there is, and the fact that other societies do not believe so does not prove the case against us. The American Society of Civil Engineers stands second to none in prestige. The character and appearance of its *Proceedings*, the discrimination it has exercised in the admission of members, the carefulness of its public expressions, the quality of its committee work, have stamped it with a distinct and enviable personality. Will the society retain that personality when advertising salesmen are peddling the society's wares? What will be the society's standing if the publication committee's query, "Shall an intensive campaign for advertising be inaugurated," be answered in the affirmative?

It should not be necessary to discuss the disturbing effect of the commerical attitude further. Engineers have always recognized a very distinct cleavage between professional and commercial thinking. The two are incompatible. You cannot serve two masters. When advertising revenue becomes big, larger than the dues, let us say, to which phase of the work will the executives of the society give the greater attention?

Yet another thought is warranted on this important subject—or rather on this *critical* subject, because it involves the entire future attitude of the society. So far has this matter of publishing been carried by certain societies that the expression "publication society" has been coined. It is for the members of the American Society of Civil Engineers to decide now whether theirs is to be a technical organization devoted to "the advancement of engineering knowledge and practice," or a publication society. To help the thinking in this direction the extreme case of the National Geographic Society is cited. Any one may become a "member" of this body by subscribing $2.50 a year for a magazine. It is distinctly devoted to the "dissemination" of geographical knowledge, but is not distinguished for work in the "advancement" of geographical knowledge. It is regarded generally as a publishing organization, not as a scientific society.

Evidently, then, there are in the publication changes of the American Society of Civil Engineers two distinct movements. The one seeks to cut the garment according to the cloth. The other already begins to expand plans for the garment in the hope that more cloth will be available—even if the additional cloth is to be bought with commercial revenue. Both movements seem to have proceeded without adequate consideration of their relation to the society's object.

The main issue is this: Shall the society through an inadequately considered publication plan depart from its principal object?

Expressed as matters of detail the issues are these:

Shall the society get its full papers and discussions in *Proceedings* or only in *Transactions?*

Shall the funds be used to publish a magazine?

Shall the society raise additional revenue by commercial means?

These are important questions. If the membership does not react sharply and strongly it may be sure that before long it will find the proposals of the publication committee in full effect. The committee has authority to proceed with the changes without consulting the membership but preferred to invite the storm, if there were to be one, rather than wait for it.

The choice is in the hands of the members. What do they want?

Cellular Flat Slabs Lighten Concrete Building

Foundations of Boston Structure Vary With Changes in Ground, but Saving in All Footings Results From Reduction in Floor Weights of Special Slab Design

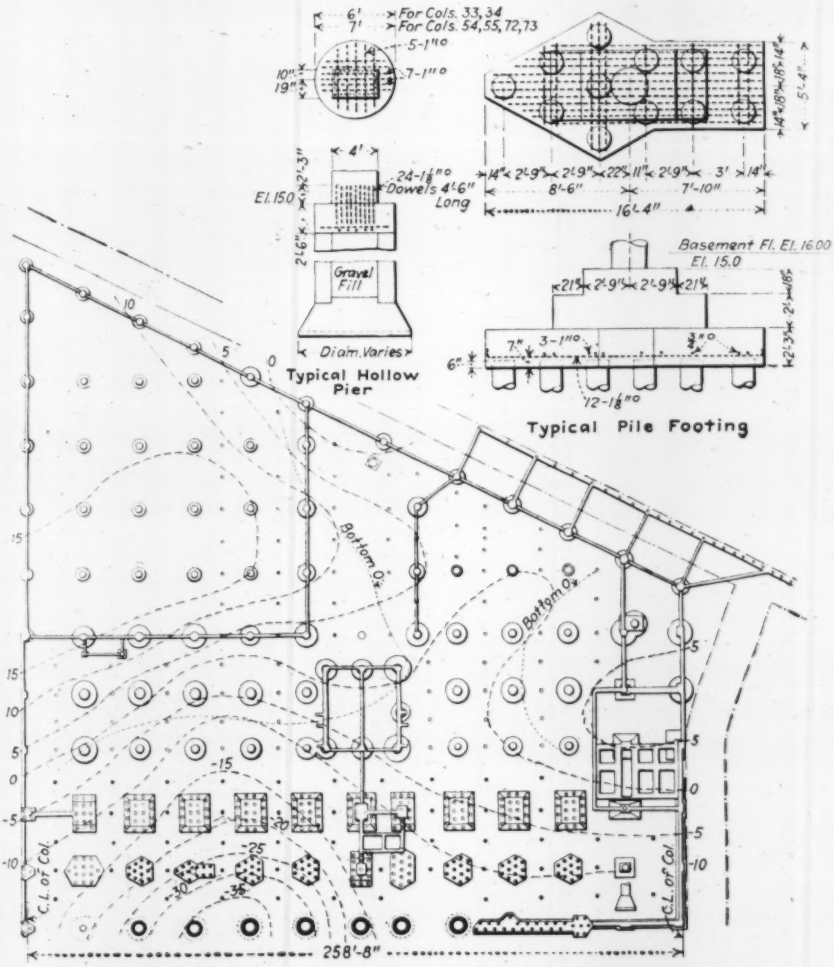
By Oren S. Hussey
Engineer, Nashua, N. H.

REINFORCED-CONCRETE flat-slab floors, in which the main slab is made up of two-way beams, were used in the new Noyes-Buick automobile building on Commonwealth Ave., in Boston. The construction saved weight in the framework itself but also materially reduced the loads on the foundations which had to be specially built on account of rather unsatisfactory soil conditions. The surface was of soft peat with underlying hardpan at irregular depths of from 8 to 30 ft. below the river level. The reduction from using the two-way slab was figured to be about 30 per cent.

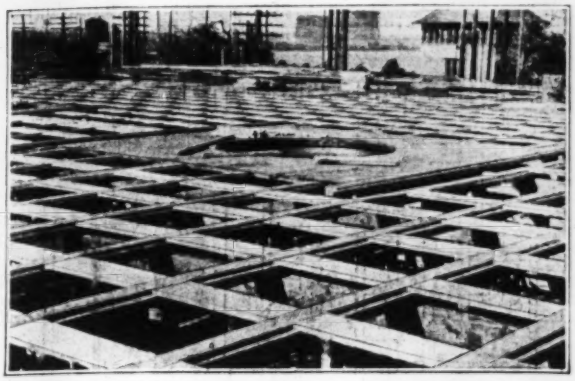
The building covers about 52,000 sq.ft. of ground area. The front section of the building is five floors high with basement and covers about 25,000 sq.ft. of surface, while the balance of the ground area is covered by a rear section consisting of one floor and a basement which is used for shop purposes. The first floor of both sections was nearly all of the two-way cellular flat-slab type of construction. The other floors and roof in the front or five-story section, except where column heads were objectionable for architectural reasons, were also of this type of construction, while the shop roof at the second story level in the rear, carried by steel trusses, was of a ribbed one-way type of construction.

The foundations used for the structure were of several types. The piers in the left rear corner were on clean, hard, fine clay sand from the basement level down, but this condition varied suddenly and often elsewhere to a maximum of 40 ft. in depth. Except for the corner mentioned above and the three rows of columns next to Commonwealth Ave., all piers were of the type largely introduced and executed by Lt. Col. Charles R. Gow and generally known as "Gow" piers. They consist of a circular concrete shaft with a spread footing or bell at the bottom and were most useful and economical at depths of from 10 to 30 ft. in wet ground where the soil immediately above the bearing stratum is peat or other material capable of being undercut to form a bell.

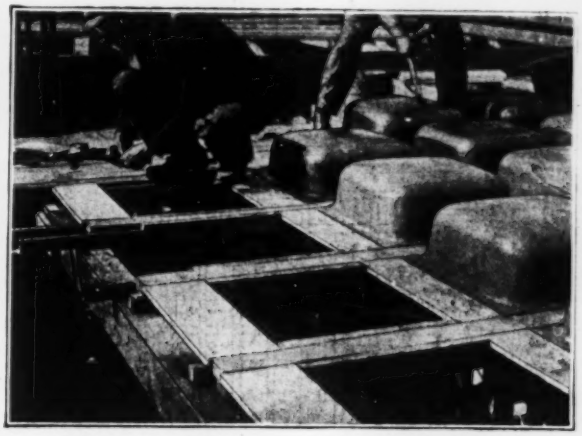
Open excavations were made within sheet steel telescopic cylinders ranging from 36 to 72 in. in diameter, the size being selected which, by reductions of 2 in. for each 5-ft. section inserted, would give the required minimum diameter at the bottom. The cylinders were excavated by hand, the bells chambered out and immediately filled with concrete, the shaft cylinders being then filled and pulled one by one. This construction gave a pier which was oversized at the top but one which required no bracing when excavated, or forms when concreted, leaving a balance in economy. To meet the conditions which were found to exist under the three front rows of piers on the Commonwealth Ave. side of the structure, it was decided to use the cast-in-place Simplex piles, 16 in. in diameter, driven by the New England Foundation Co. These piles were designed to carry from 25 to 30 tons each with a penetration of from 10 to 12 ft. into sand and gravel



FOUNDATION LAYOUT OF NOYES-BUICK BUILDING SHOWING HARD BOTTOM CONTOURS AND VARIED FOOTING



FORMS FOR SUPPORTING FLAT-SLAB PANS



PUTTING FLOOR PANS IN PLACE

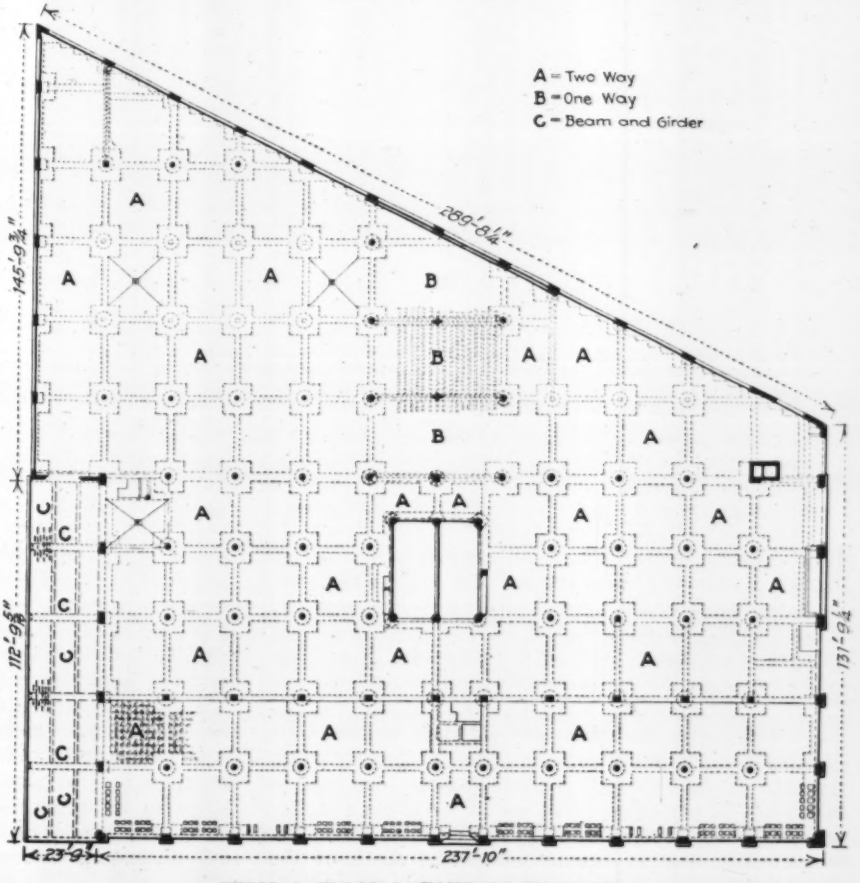
subsoil. They were driven with a 3,600-lb. drop hammer and showed a penetration of from 1 to 3 in. from the last eight blows, a constant drop of 10 ft. being maintained with the hammer, and a penetration into bottom of from 8 to 16 ft. Pile No. 11, having a penetration of 1½ in. in the last eight blows and approximately 10 ft into bottom, was given a load test. The test showed a permanent settlement of 0.03 ft. under a three-day application of 55 tons; a load of 60 tons increased the permanent settlement to 0.053 ft. This was considered a satisfactory test for the designed load of 27 tons.

In the front row of piles and in parts of the second row, it was found impracticable to drive the ¾-in. heavy Mannesmann steel tubes, forming the temporary pile casings, through the thirty or more feet of gravel filling, or, when this was accomplished, the added resistance of the hard bottom prevented further penetration. Persistent attempts ruined tubes and machinery used for driving and recourse was had to open end caissons for the street front foundations.

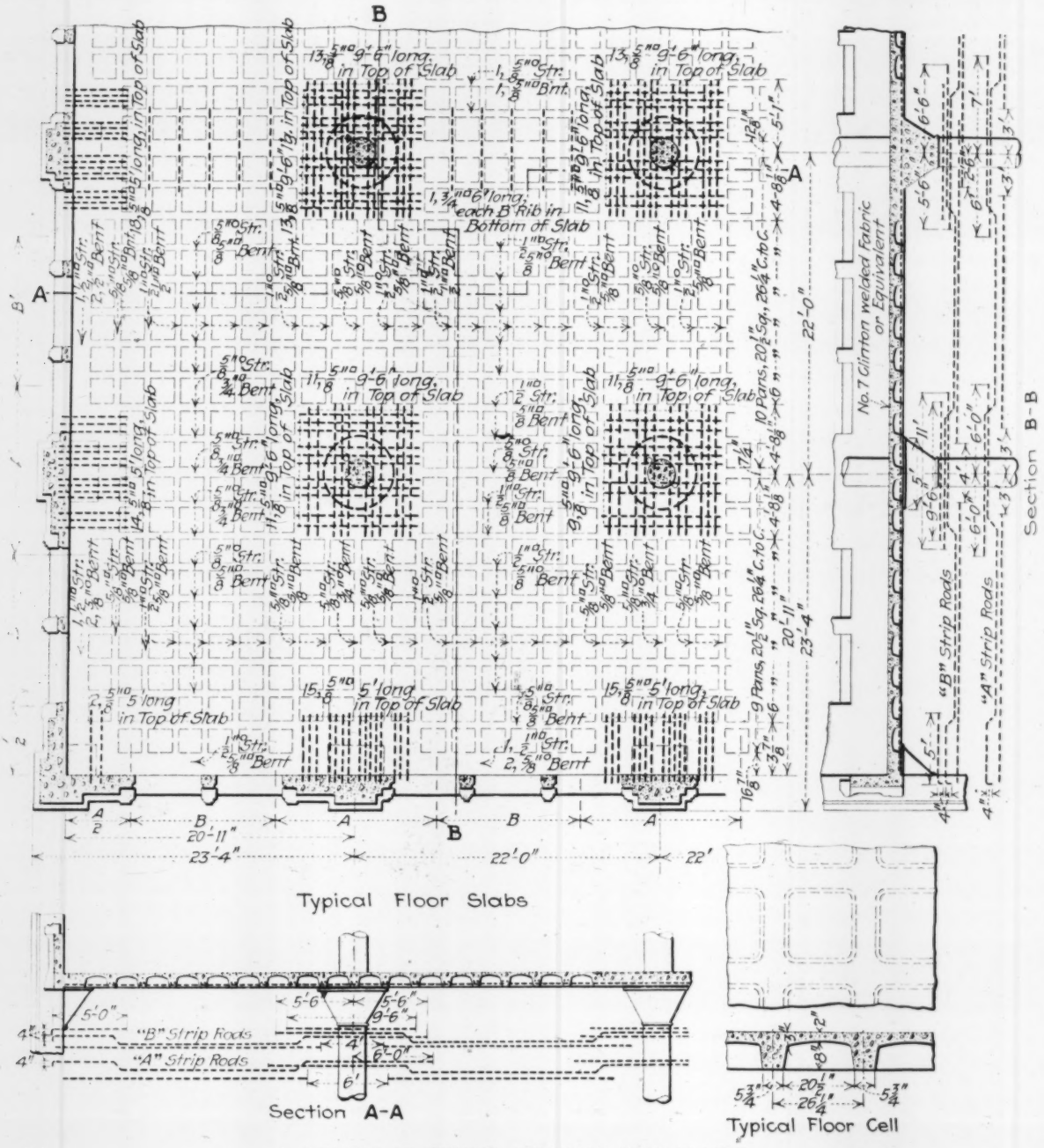
Because of the shallow depths of the underlying peat, two feet or less, which prevented chambering for bells, the contractor provided caissons of 8-in. shells cast in place with an outside diameter nearly or quite equal to the bell diameter and carrying a short steel cutting edge at the bottom. These were excavated by hand as in the case of the other piers, the bell and core being poured full when the bottom was reached. The majority of these piers were sunk by gravity but an occasional pier required jacking down, the surrounding earth being used for load.

In the center of each basement bay, a concrete pile or a dug pier was sunk to support the basement floor loads, the underlying earth being equal to the requirements.

The major part of the typical floor, as shown in one of the drawings, is of the cellular flat-slab type, that is a girderless reinforced-concrete floor system in which there is the usual column, capital and column head but in which the slab proper instead of being of uniform thickness is of criss-crossed reinforced-beams made by dome forms which are removed, leaving the honey-comb or waffle-like ceiling shown in one of the views. The



TYPICAL FLOOR LAYOUT OF BUILDING



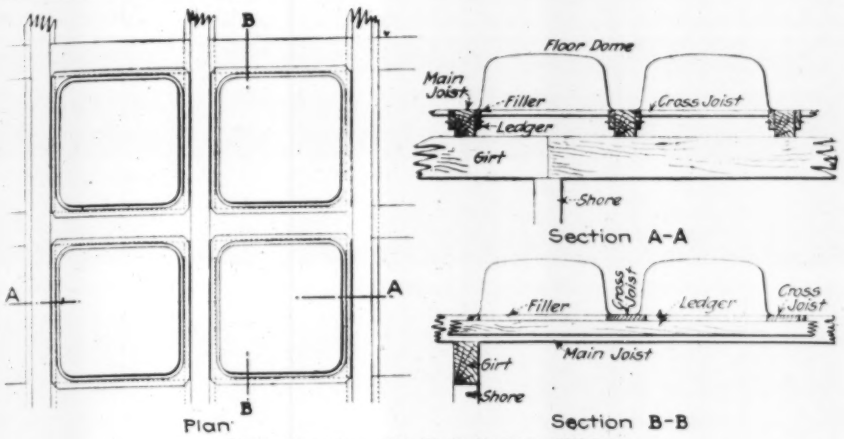
DETAILS OF TYPICAL CELLULAR FLAT SLABS

panels varied in area but a typical interior panel was 22 ft. square, with a 5-ft. capital and a column head 9 ft. 4 in. square. Domes 20½ in. square left beams 5¾ in. wide at bottom on 26¼-in. centers both ways. Reinforcement as shown in the typical panel drawing consisted of rods in the bottom of beams in both directions, bent up over the supports and supplemented by extra bars criss-crossed in the upper part of the column head.

One of the drawings herewith gives the moments as figured for a typical interior panel under the provisions of the Boston building code as given in the caption to the cut. Under this code the building was designed to carry 150 lb. per square foot less a reduction for slab areas exceeding 300 sq.ft. of 25 per cent, or a net live-load of 112½ lb. per square foot. The depth of the floors was uniformly 10 in. without dropheads regardless of the change in span from 22 to 25 ft. Of this total depth, 2 in. was taken up by the top slab, the balance being the depth of the rib and fillets on either side of the rib. The building law permitted concrete fire protection below the steel of ¾ in. for flat slabs and 1½ in. for the beams or ribs; the value of *d* therefore was 7.88 in., this value being taken as the mean of the depths in each direction.

In order to secure the cellular steel forms for the slab, steel domes, manufactured by the Truscon Steel Co., Youngstown, Ohio, were purchased under a guarantee against patent infringements. These domes, shown in an accompanying view, were about 20 in. square with flanges of 1 in. additional on each side, 8 in. in depth and made from No. 16 gage metal, hot pressed.

The weight of the floor, 9½ in. thick, under ordinary



DETAILS OF PANS FOR FLOOR CELLS

conditions, would have been approximately 115 lb. per square foot outside of the area of the plinths; the actual weight of the floor, as constructed with cellular flat slab, steel domes, manufactured by the Truscon Steel purposes of computation was taken at 80 lb. per square foot, including the plinths. It will therefore be seen that, with the form of construction adopted in this building, the saving in weight was somewhat over 30 per cent; the saving in load on the columns was about 15 per cent and slightly more on the foundations. As the depth of the steel, i.e. the value of *d*, was substantially the same in either design, the saving in this was directly proportional to the total loads, or about 15 per cent.

It can be seen that the wisdom of adopting the design used in the construction of this building would depend largely upon the matter of forms and the cost of the same—the saving in other directions being obvious. In designing the forms, the purpose was not only to effect economy in construction but also to permit of the ready removal of the steel domes without disturbing the posts supporting the fresh concrete. It had been found that the domes could be removed at the end of two or three days, after the concrete had been poured to good advantage and used over again in other parts of the work, thus reducing the number of domes required for any particular work. To permit of this ready removal of the domes, 4 x 4-in. joists, planed on top with 2 x ¾-in. ledgers nailed on the sides and ⅞-in. below the top of the joists, were used. These compound beams were formed and then laid parallel, 26½ in. apart with 8 x ¾-in. cross pieces laid also on 26-in. centers. This arrangement, by the use of double-headed nails, permitted the ledgers to be moved and the domes dropped without disturbing the joists or posts. In order to more easily drop the domes in case of their sticking in the concrete, a lever was used which engaged small holes in the side walls of the domes; no difficulty was experienced in removing the domes except in some instances when they had been left in place too long.

The domes were used over repeatedly in the construction of this building and when finished with, were apparently in as good condition as when new. It was necessary, however, that they be well greased before being placed in position and care was taken to see that this was done. The accompanying cuts show the construction of the compound beams and the methods used in placing them in position to hold the domes.

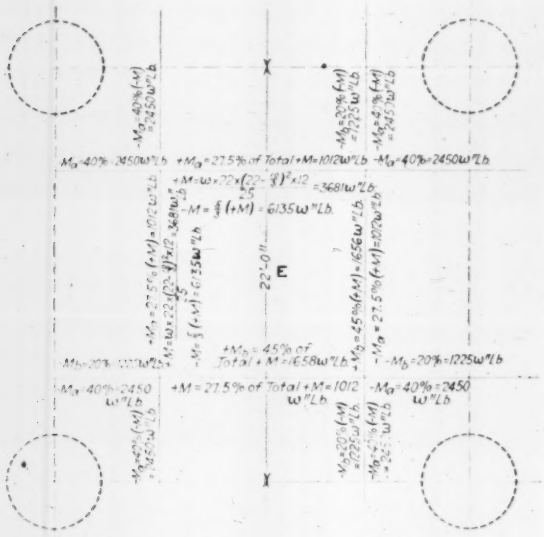
The contractor reported that the cost of forms, constructed as described above, was substantially identical with the cost of ordinary flat-slab forms but observation of the work indicated that there should be a material saving made because of the repeated use of and the great facility with which the forms were erected after the first time.

FLOOR PANS AND REINFORCEMENT BEFORE PLACING CONCRETE

The determining factor of this design, as worked out by the Joint Committee methods, appears to be the negative compression in the rib at the "mid section" and there is also, in some cases, danger of excessive shear near the plinth in the column sections. Either one or the other difficulty may be overcome, however, by providing tapered ribs which would require special forms. The tapered ribs were not used in the Noyes-Buick building as they were not considered necessary in that particular case.

Pans New in Flat-Slab Work

Square pans have been used in concrete design for a good many years, but, so far as is known, they have not been used in flat-slab computations until recently. It would appear that their use in such computations is entirely legitimate and consistent with the Joint Committee conclusions except possibly in the matter of reducing the allowance made by that committee for the tensile strength of the positive moment concrete. The Boston Building Department solved this possible difficulty by allowing 18,000 lb. per square inch on the steel in all sections except where the tensile steel was in the



MOMENTS ON MIDDLE FLAT SLAB PANEL

Formulas used are from Boston Building Law.
Total moments for entire width of bays

$$\text{Interior bays:} \quad +M = \frac{wLl^2}{25}$$

$$-M = \frac{wLl^2}{15}$$

$$\text{Wall bays:} \quad +M = \frac{wLl_1^2}{20}$$

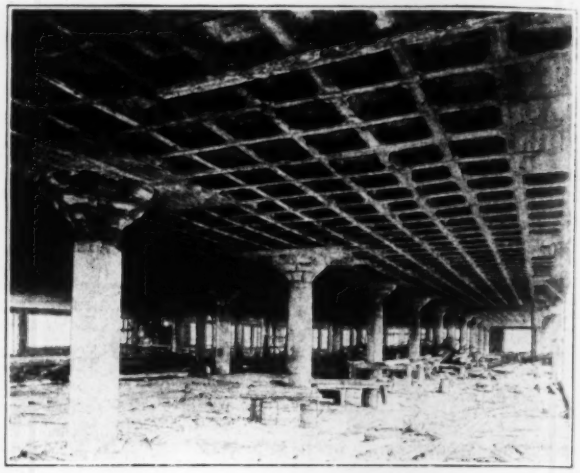
$$\text{at wall} \quad -M = \frac{wLl_1^2}{30}$$

$$\text{at interior cols.} \quad -M = \frac{wLl_1^2}{12.5}$$

in which:
- w = total weight of floor per sq.ft.
- L = width of panel at right angles to strip considered.
- l = length of strip center to center of columns—$\frac{2}{3}$ dia. of interior column capital.
- l_1 = length of strip from face of wall column —$\frac{1}{3}$ dia. of interior column capital

lower side of the rib; in such cases, the allowance was reduced to 16,000 lb. per square inch.

In 1917, Nils F. Ambursen proposed the use of the cellular steel pans or domes in connection with a patent "Uni-Form System" of steel forms and with W. L. Church, consulting engineer for the Blaw-Knox Co., worked out an elaborate series of computations to permit of preliminary convenient and economical designing. On June 17, 1919, a patent, No. 1,307,031, was issued to Edwin Albright—now assigned to the Des Lauries Column Mould Co.—for the combination of dome and flat-slab construction. There has been some controversy over this patent but as responsible manufacturers of domes are willing to guarantee the user against infringement suits, there should be no hesitancy shown by engineers in using this valuable method of floor design. Whatever the facts as to invention and patent rights are, much credit is due Mr. Allbright for his good work in perfecting the practical details of this type of construction and for erecting some typical buildings.



COMPLETED CELLULAR FLAT SLAB FLOOR FROM BELOW

The general contractor for the Noyes-Buick building was the F. T. Ley Co., of Springfield, Mass., the architect, A. H. Bowditch, of Boston, Mass., and the engineer responsible for structural design, Henry F. Bryant, of Brookline, Mass.

Activated-Sludge Process at Sydney, Australia

Six activated-sludge tanks have been built to displace septic tanks for the treatment of the sewage of Syndey, Australia, according to the annual report of the Metropolitan Board of Water Cupply and Sewage for 1919-20 (J. M. Smail, chief engineer.) Three of the six tanks were in operation at the end of the year and were treating an average of 900,000 Imp. gal. a day. "The most recent conclusion" as to operation, says the *Journal* of the Institution of Municipal and County Engineers (London) in a synopsis of the Sydney report, is "that the tanks could be operated at a 12-hr. cycle, allowing two fills a day." This rate could be exceeded with the dilute sewage of wet weather. The 12-hr. cycle includes filling and aerating 7 hr.; settling, 2 hr.; decanting, 1 hr.; sludge aeration, 2 hr. The sludge is kept at about 20 per cent of the capacity of the tanks.

On methods of sludge disposal the *Journal's* abstract says:

For the first five months of the year, before decanting the excess sludge from a tank, settlement was allowed to go for four hours, and the amount then sent to sea was at the rate of 75 cu.yd. per 1,000,000 (Imp.) gal. of sewage. For the remainder of the year the excess sludge was run into a spare tank, kept aërated, and when a certain amount had accumulated, settled for some hours. The supernatant liquid was conducted over the sand beds on which a corn crop was growing, much to the benefit of the same. On account of the shortened time of settlement in the treatment tank, 1,000,000 (Imp.) gal. of sewage produced 135 yd. of sludge, but by settling it again in another tank as described, the amount sent to sea finally was only 43 yd. per million—a saving of over 42 per cent on the earlier figures, and a considerable saving from a monetary point of view in puntage charges.

Experiments were made to de-water the sludge by means of a centrifuge. It was found that practical results could be obtained and that about four-fifths of the original water could be removed. Further experiments are being conducted to de-water by treatment in an artificial filter bed of coarse gravel.

Federal Highway Council Plans Intensive Subgrade Study

A THOROUGH study of highway subgrades with a view to the elimination of road failure due to poor foundations by increases in metal thicknesses, and by strengthening the bearing power of soils through mechanical or chemical treatment, is outlined in the report of the Committee on Subgrade and its Relation to Road Surfacing and Traffic, recently submitted at the meeting of the Federal Highway Council at Akron, Ohio.

Realizing that, owing to the increase in commercial motor vehicle traffic, wheel concentrations on the road surface combined with lack of supporting value of the underlying subgrade, have resulted in structural failures of every type of road constructed up to the present time, the committee believes that neither time nor expense should be spared in making generally available all possible information upon the bearing value of soils. It believes that the problems of eliminating road failures due to poor foundation are possible of solution in one of three ways:

1. By making the road surface thick enough so that the pressure from heavy traffic will be sufficiently distributed to the underlying subgrade, or so that the surface because of its inertia may absorb a considerable amount of the shock of traffic.

2. By designing the slabs to have sufficient strength to bridge over the soft subgrade.

3. By improving drainage systems to exclude moisture in sufficient amounts from soils which are rendered of low bearing value by the presence of moisture.

Problems Outlined for Study

In order to make an adequate subgrade study, the committee has outlined a number of problems which it intends to solve through the co-operation of various sub-committees. These problems are:

(1) Obtain samples of subgrade material at points where failures have occurred; also samples from the same road of like construction and like traffic where failures have not occurred. Data accompanying the samples should contain information as to the topography, type of drainage, character of construction, and all other information having relation to the condition of the road; make a physical examination, bearing value tests, and such other investigations as may be suggested with data furnished; (2) development of field tests for bearing power of soils; (3) making studies of drainage, using experimental sections of roads; (4) a study of chemical methods of subgrade treatment for increasing bearing value or preventing absorption; (5) a study of mechanical methods of subgrade treatment; (6) a study of freezing and thawing on the volume and on the supporting properties of soil; (7) a study of the effect of moisture on the volume changes in soil; (8) a study of the transmission of pressure to the subgrade; (9) a study to ascertain the practical classification of subgrade materials; (10) any special problems that arise.

In order to expedite the work of the various committees handling these problems, a tentative outline of procedure has been drawn up which will serve as a guide to the sub-committees and enable them to decide in the shortest possible time upon the method of procedure to be followed by them in their studies. The various sub-committees are expected to report upon proposed procedure to the special advisory committee not later than Nov. 15, and after this date the sub-committees should be able to pursue actively their various investigations. The committee believes that most soils have adequate bearing value when they have a sufficiently low percentage of moisture; and that it is not impossible that some soils will be susceptible of treatment, either mechanically or chemically, which will render them of a higher bearing value than they have in their natural condition.

Importance of Work Recognized

The committee recognizes the importance of the work and the necessity for obtaining results in the shortest time. Its report reads that "an investigation of methods for obtaining high-class construction should very properly be considered as a part of any program of construction and it should be emphasized that of the funds appropriated for road construction there should be set aside an adequate portion for pursuing the needed investigation to make for wise expenditure of these funds." The subgrade committee of the Federal Highway Council has as its chairman General Coleman Du Pont and as its vice-chairman, C. M. Upham, state highway engineer of Delaware.

Direct-Process Native Furnace Iron Like Metal in Delhi Pillar

NATIVE Indian direct-process furnaces are still making wrought iron from ore and producing a material which is exactly the same as the iron of the world-famous Delhi pillar. It has been known for some considerable time that this pillar is welded up of a large number of small pieces of wrought iron, each representing a single heat of a small hand-blown direct-process furnace. Andrew McWilliam describes in detail the operation of such a furnace in a paper just read before the Iron and Steel Institute ("Indian Iron Making at Mirjati, Chota Nagpur").

The furnace described was operating within five miles of a large modern steelworks, and was producing iron used for all sorts of native tools and other articles, including plows, sickles, axes, knives, and the like. The furnace worked on hematite found locally, and charcoal made in the adjoining jungle. The furnace is reported as being 15 in. in interior diameter at the bottom, 4½ in. at the top, and 3 ft. 10 in. high. The charge was raked in bit by bit at the top as the burden goes down during the process of the combustion and reduction. Two foot-power bellows supplied the blast. The full time required to run a heat was 5½ hr. The product was a spongy mass of iron which when forged out into bars weighed 14 lb. 8 oz. Analysis of the product showed carbon 0.06, silicon 0.22, sulphur 0.03, phosphorus 0.20 per cent, and a trace of manganese. Analyses of iron from the Delhi pillar by Hadfield are reported as showing carbon 0.08, silicon 0.05, sulphur 0.01, phosphorus 0.11 per cent, but the amounts of all these alloying elements in the native-made iron vary considerably, and the two products quoted are to be regarded as identical, according to McWilliams.

Density Tests of Earth Shrinkage in Railway Fills

Samples Taken by Special Device Indicate Swell and Shrinkage According to Depth in Original Excavation

DENSITY tests of earth samples made recently by the valuation department of the Chicago, Burlington and Quincy R.R. resulted in the conclusion that shrinkage in embankment from original excavation bears a definite relation to the depth of excavation and showed the relation of depth to weight of earth and apparent "shrinkage" from subsidence of subgrade. The density method consists in comparing the weight of the net metallic content of equal samples of unmolested earth from an embankment and from the natural bed adjacent to the excavation which supplied material for the embankment. This net metallic content is taken as the weight of the sample after drying, the moisture content being eliminated by the heat. Difference in weight is taken as the measurement of change in volume.

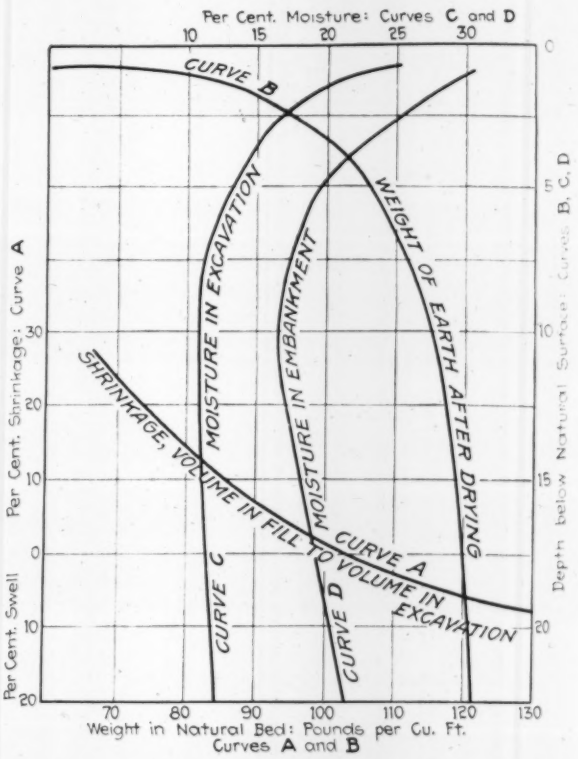
At the point where a sample was to be taken, a pit was dug to the level of the top of the sample and then continued around the marked area of sample for a depth of about 18 in., leaving a pedestal of undisturbed material. For cutting the sample, a steel cylinder 10 in. long and 10⅜ in. in inside diameter was used, having one end beveled to a cutting edge and the other end threaded for a screw cap. By means of a driving cap this cylinder was forced down into the undisturbed pedestal until the core projected above the top. The projecting earth was cut off level with the top of the cylinder and the cover was screwed on. The lower part of the pedestal was broken off with a shovel, the cylinder being then inverted and protruding earth sawed off level with the cutting edge. The sample thus taken was emptied into a closely woven sack and sent to the railway company's laboratory, where it was broken up and dried at 170 deg. F. until by successive weighings no further loss in weight was obtained. In all, 89 samples were taken of clay, loam and gumbo in glacial drift formation in Iowa, Illinois and Missouri.

It soon became apparent that the shrinkage bore some relation to the weight of the earth in its natural bed. This condition is illustrated by curve *A* in the accompanying diagram. It was discovered also that the dry weight of material in its natural bed bore a relation to depth below the natural surface, as shown by curve *B*. Further, the records indicate a greater moisture content in samples from embankment than in those from excavation, as indicated by curves *C* and *D*. This moisture content was taken as the condition when the sample was received at the laboratory.

These studies indicate, says the report, that earth the metallic content of which in the natural bed weighs less than 103 lb. per cubic foot shrinks when placed in embankment subjected to traffic, but when this weight exceeds 103 lb. the material retains a more or less permanent swell. As shrinkage bears a relation to weight and weight bears a relation to depth below the surface, the shrinkage of a fill has some relation to the depth at which the material occurred in the excavation.

Upon this evidence is based the conclusion that earth obtained in excavation down to 4 ft. below the surface will shrink when placed in embankment, but that material taken at greater depths will swell. The former condition is the more important, according to the report, since ordinarily from 60 to 100 per cent of a railway embankment is of material obtained within the 4 ft. depth. Practically all side borrow falls in this class and the top 4 ft. of a railway cut contains a relatively large yardage on account of the trapezoidal section of the cut.

Traffic as a factor in shrinkage, due to load and vibration, is indicated by samples of similar material taken from embankments subjected to different conditions:



TESTS OF EARTH SHRINKAGE SHOW RELATION TO DEPTH IN ORIGINAL EXCAVATION

No. 1. Embankment 17 years old, built for future double tracking but having no track laid. Shrinkage, 6.7 per cent.

No. 2. Embankment 49 years old but abandoned after 32 years of traffic with light equipment. Shrinkage, 12.9 per cent.

No. 3. Embankment 17 years old and subjected to traffic of the heaviest equipment during the entire period. Shrinkage, 13.6 per cent.

For the purposes of these tests the problem was to determine what percentage should be added to embankment (for the valuation inventory) to produce the yardage which would have to be moved to make the embankment. Therefore, there was developed an "additive factor" or percentage, which is somewhat different from the term "shrinkage." For all embankments in Iowa an average additive factor for net shrinkage of 11.55 per cent was indicated by the tests. The report points out, however, that the sides of an embankment, including the quantities in the outside 3-ft. slab or beyond slope lines drawn from the toes of the ballast, are clear of the influence of loading and are subject to a frost action which neutralizes shrinkage. Eliminating these areas, the additive factor for shrinkage would be reduced by 20 per cent, or to a net figure of 9.24 per cent.

An unmeasured subsidence of the earth under all embankments is indicated, says the report, by the established characteristic of extremely high shrinkage of surface soil, which characteristic is supported by common knowledge of the high porosity and void content of surface soil. It is considered obvious that if this earth will shrink when placed in embankments it will be compressed in its natural bed by the load of the embankment and the effect of traffic, producing an apparent "shrinkage" from subsidence of subgrade. It is concluded that under grading conditions in Iowa this will add 3 per cent to the apparent shrinkage of the embankment.

CONSTRUCTION ALLOWANCE

Loss of material by wastage in transportation from cut to fill and by wind and rain erosion during construction and prior to operation is difficult to estimate, but the report states that such loss will readily be admitted by all engineers experienced in or familiar with railway construction. It suggests that possibly this may be covered by adding "some small percentage based upon opinions of many competent minds," but does not offer any figures for this allowance. On the basis of 9.24 per cent for shrinkage and 3 per cent for subsidence, the total additive factor for shrinkage for Iowa embankment is taken as 12.24 per cent, without considering subsidence separately.

These density tests were made under the direction of H. S. Marshall, valuation engineer of the Chicago, Burlington & Quincy R.R. His report is given as an appendix to the report on swell of rock and shrinkage of earth by a sub-committee of the Railway Presidents' Conference Committee, published in *Engineering News-Record*, Aug. 26, 1920, p. 418.

Tar Macadam Roads Show Lowest Total Annual Cost

A TAR macadam road constructed of an 8-in. broken stone foundation, a surfacing of crushed rock 2 in. thick laid in two 1-in. courses and impregnated with 1 gal. of tar per square yard, shows the least expenditure—interest on original cost and maintenance—per mile per year in a comparison of six types of surfacing made by J. A. Johnston, district engineer, District 1, Division of Highways, Massachusetts Department of Public Works. Other types included in the comparison are waterbound macadam, asphalt mix, asphalt penetration, concrete and gravel. The roads compared were chosen because of the availability of their maintenance data, because they were typical examples of their types, and because all, save concrete, are built of the same foundation thickness and foundation material.

The tar macadam, which has been patented by Mr. Johnston, is distinguished from a number of other bituminous types by the fact that the 2-in. surface was laid not in one but in two courses. The foundation is built in the same manner as that for numerous bituminous types. Upon the foundation is placed broken stone not less than 1½ in. in longest dimension. The stone is so spread that after thorough rolling the resultant surface will be 2 in below the finished surface of the road. Depressions formed under rolling are filled with 1½-in. stone and rolling is continued until an unyielding surface is obtained. On the surface so prepared is spread a layer of broken stone ranging in size from ¾ in. to 1½ in. This layer completely covers the base, though with the thinnest possi-

SUMMARY OF AVERAGE COSTS PER YEAR

	Water Bd. Mac.		Asphalt Mix		Asphalt Pen.		Concrete		Gravel (Oiled)		Tar Macadam Johnston Process	
	Mile	Sq.Yd.	Mile	Sq.Yd.	Mile	Sq.Yd.	Mile	Sq.Yd.	Mile	Sq.Yd.	Mile	Sq.Yd.
Expenditure	519.24	0.047	143.44	0.013	101.09	0.009	35.59	0.003	341.34	0.031	93.05	0.008
Interest	435.56	0.040	644.69	0.059	492.18	0.045	581.63	0.053	244.64	0.022	340.53	0.031
Total	954.80	0.087	788.13	0.072	593.27	0.054	617.22	0.056	585.98	0.053	433.58	0.039

DETAILED COST FIGURES ON FOURTEEN HIGHWAYS COVERING SIX TYPES

	Type and Location												
	Water-bound Macadam	Asphalt Mix			Asphalt Penetration			Concrete			Gravel	Tar Macadam Johnston Process	
Cost	Oiled Great Barrington	West Springfield	Chicopee	South Hadley	Northampton Br.	Lee (So.)	Northampton River Road	Hancock	North Adams	Wilbraham	(Oiled) Sheffield	Oxford	Lee	Dudley
1913 Cost	.....	.....	**$15,363**	.....	.....	.....	**$10,890**	.....	.....	.....	.....	**$7,645**	**$9,988**	.....
1914 Cost	.....	.....	.....	.....	**$14,762**	.....	.....	.....	.....	.....	$6,116	.....	.....	.....
Int. at 4%	.....	.....	615	.....	.....	.....	436	.....	.....	.....	..	306	400	.....
Expenditure	.....	.....	.....	.....	.....	.....	43	.....	.....	.....	.....	368	63	.....
1915 Cost	.....	**$17,798**	.....	**$15,191**	.....	**$11,264**	.....	.....	.....	.....	.....	.....	.....	.....
Int. at 4%	.....	.....	615	.....	590	.....	436	.....	.....	.. ..	245	306	400	.....
Expenditure	.....	506	1	.....	10	.....	30	.....	.....	.....	234	86	140	.....
1916 Cost	**$10,889**	.....	.....	.....	.....	.....	.....	**$16,441**	**$15,851**	**$11,330**	.....	.....	.....	**$1,909**
Int. at 4%	.....	712	615	608	590	451	436	.....	.....	.....	245	306	400	.....
Expenditure	.....	546	43	17	12	39	1	.....	.....	.....	231	167	.....	.....
1917 Cost	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Int. at 4%	436	712	615	608	590	451	436	658	634	453	245	306	400	316
Expenditure	452	.....	627	30	293	49	54	33	13	32	417	115	10	30
1918 Cost	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Int. at 4%	436	712	615	608	590	451	436	658	634	453	245	306	400	316
Expenditure	518	.....	.....	23	224	453	97	48	13	30	572	239	12	.....
1919 Cost	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Int. at 4%	436	712	615	608	590	451	436	658	634	453	245	306	400	316
Expenditure	588	.....	150	52	51	38	20	31	51	59	253	184	230	.....
Av. Cost per Yr.														
Per Mile	**955**	**975**	**751**	**638**	**708**	**595**	**476**	**695**	**660**	**493**	**586**	**499**	**475**	**326**
Per Sq.Yd.	**0.087**	**0.089**	**0.068**	**0.058**	**0.064**	**0.054**	**0.043**	**0.063**	**0.060**	**0.045**	**0.053**	**0.045**	**0.043**	**0.030**

ble blanket. It is then sprinkled with water and when still wet there is sprayed over it a layer of bitumen heated to 250 deg., applied with a mechanical sprayer and at a pressure of 70 to 80 lb. per square foot; and at the rate of ½ gal. of bitumen per square yard of surface. Over this bitumen is laid coarse clean sand, about 0.02 cu.yd. of sand per square yard of surface being used. Another layer of ¾-in. to 1½-in. stone is then spread, bringing the surface to within ½ in. of the finished grade. The whole is then watered and rolled, any depressions filled, and again rolled. It is then watered and while still wet is treated with bitumen as before, though this coat is applied at the rate of ½ gal. per square yard. Stone chips then cover this bitumen coat, the surface is again wetted and another layer of bitumen applied and covered in the same manner as the previous one, except that more stone chips are used the second time. The whole road is then watered and thoroughly rolled, any excess bitumen being absorbed by the use of more stone chips. Rolling is continued until there is no movement of the surface under the roller and until the road is thoroughly compacted.

Costs Compared

Costs in the comparison do not include grading and drainage. As those items would be the same no matter what type of surfacing is used, varying only with location, they were omitted from the calculations. Absolute comparison was possible by figuring cost per mile for each type on an area of 11,000 sq.yd. Costs in the accompanying table include the annual interest at 4 per cent upon the original cost per mile (foundation and surface only) and the total annual cost of all surface maintenance as reported by District Engineer Johnston to the Division of Highways of the Massachussets Department of Public Works.

The waterbound macadam had an 8-in. broken stone foundation upon which was laid a 4-in. course of crushed stone, the whole watered and compacted and then treated with light oil, ½ gal. to the square yard being used. Maintenance consisted in yearly applications of an average of ¼ gal. of oil to the square yard. The asphalt mix was built of the same 8-in. base upon which was laid 2 in. of crushed stone ranging in size from 2½ in. to that passing a ¼ in. screen, the top course consisting of a 2-in. asphalt-mix blanket. It was maintained by patching and yearly applications of a light coat of sand.

Construction Methods

The 8-in. foundation of the asphalt penetration roads was covered with a 4-in. depth of crushed stone, the upper 2 in. of which were treated with 2 gal. of asphalt per square yard. Maintenance of this type included patching and yearly coats of light sand.

The concrete road was of an average thickness of 6 in., a 1:2:4 mix being used.

The gravel roads were constructed of an average depth of 6 in. of gravel laid upon an 8-in. broken stone foundation. A half gallon of light oil per square yard was used at the time of construction and the roads maintained with yearly application of ¼ gal. of light oil to the square yard.

The tar macadam roads were maintained by spraying, as found necessary, in from three to five-year periods with ½ gal. tar to the square yard.

Stadia Survey for Irrigation Project

TOPOGRAPHIC surveys for Toole County irrigation district, Montana are being made by the stadia method, partly because the country is very windy and partly because both the chief engineer and the engineer in charge have had considerable experience in stadia work. Each party is composed of an instrument man, a recorder and three rodmen. The work is run in closed circuits. Starting at a government corner, the elevation of which has previously been established by a level control line, the survey runs out two miles, over half a mile, and back two miles to a corner with known elevation. Each circuit must close within one foot for elevation and within 30 ft. per mile for line and distance, or the circuit is re-run. The party has an automobile to carry it to and from the field and to carry the instrument man and recorder between stations.

The survey system has been planned carefully and satisfactory progress is being made. The largest area covered in one day with one party is 1,920 acres; 900 shots were taken on this acreage, which makes about one shot per two acres. As the land is level, it is well covered by this number of shots. Topographic data are plotted on a scale of 300 ft. to the inch, which permits of 1-ft. contours being plotted over most of the area. The topography party also makes a preliminary classification of the lands as to suitability for irrigation, using growing vegetation and the appearance of the surface as a basis. This information is signalled to the instrument man by the rodman and noted by the recorder.

Reservoir sites are also surveyed by stadia, using practically the same method except that the level control line is the proposed water elevation in the reservoir. Main ditch line surveys are made in the usual way with transit and level, using stadia for topography. Enough information is obtained to make a paper location and estimate of cost.

Surveys were commenced in the fall of 1919 and covered 60,000 acres out of a total of 300,000 acres. The parties were in the field until the middle of December and started again in April, 1920. It is expected to complete the field work this summer and to work up the notes and prepare an estimate of cost during the winter, preparatory to floating a bond issue. The cost probably will be in the neighborhood of $10,000,000. The engineering work is being done by the Gerharz-Jaqueth Engineering Co., Great Falls, Mont., under the direct charge of Henry Gerharz, president, as chief engineer.

Plan Road and Car Viaduct for Duluth

A high-level viaduct connection from the low lying business district of Duluth, Minn., to the high ground behind the city has been suggested by H. C. Ash, assistant engineer of the Duluth, Missabe & Northern Ry., as a possible solution of a local transportation problem. The high ground, with an elevation of 400 to 600 ft., is within ¾-mile of the city, but the steep approaches retard its development for dairy, truck garden and residence purposes. The viaduct with roadways and car tracks would have an easy grade and terminate at the roof of a skyscraper office building about 350 ft., high, with elevators for passengers, automobiles, wagons and street cars. A similar intermediate building might be utilized as a city market and office building. Suburban cars would operate on a loop through the city and then be raised to the track level of the viaduct.

Adapting Motor Truck to Railroad Terminal Expansion

Possibilities for Reducing Multiplicity of Car Movement and Meeting Growing Needs of Industrial Development

Extracts from a paper by B. F. Fitch, president, Motor Terminals Co., New York and Cleveland, presented before Cleveland Engineering Society, Oct. 12, 1920.

NO LESS an authority than Robert W. Woolley, of the Interstate Commerce Commission, is accredited with the statement that less-than-carload terminal costs represent 60 per cent of revenue. The deduction is but logical that the major portion of economies can best be effected through terminal refinements.

Multiplicity of Terminal Car Movements

Were each of our terminal cities building and breaking cars for one station at all the other principal common points in the United States, our transportation problem would be comparatively easy, but when we multiply the number of cities by the plurality of stations within each, from which car loadings must be consolidated for dispatch, to the plurality of stations within each other terminal, the interchange, consolidation and dispatch problem is kaleidoscopic. If we visualize the individual movements of all these multiplied box-car loadings for line dispatch and add the intra-terminal movement of carloads and less-than-carloads from industrial sidings, our sympathies are aroused for railroad talent. If, to this operating dilemma we add the increased tonnage capacity from trackage and equipment improvements which have made our railroads the models of the civilized world, all of which have been successfully developed while our terminals were considered a side issue, it is no wonder that the subject of inadequate terminals has now become the engrossing topic of the hour. The problem is all the more interesting and complex because of the varying restrictions in the form of realty development, street intersections, industrial growth, etc., which makes the extension of centrally located properties impossible, except at prohibitive investment.

At the congested terminal of Cincinnati, Ohio, an expedient has been tested, first in a small way and later universally by the railroads, to ascertain to what extent motor trucks could be adopted by railroads contributing to that terminal as an accessory to transportation. The Big Four R.R. first used the new system, starting operation in May, 1917, between its five main and substation. The original crude installation of open bodies with tarpaulins, moved between these five stations, developed such marked operating economies that its use was recommended for extension to all other contributing lines. With authority of the United States Railroad Administration, a detail analysis of all connecting line and substation intra-terminal movements was made. This disclosed that approximately 800 tons were available for transportation between main stations and 400 tons between main and substations daily.

Adaptation of Motor Transfer

At that time approximately 40 per cent of the main station interchange tonnage only was being transported by horse drays, and the remaining 60 per cent, of necessity, was interchanged by trap cars between these main stations, as well as all substation tonnage. There were 115 heavy drays in service to transport the 40 per cent of inter-line tonnage, and hence to transport 100 per cent, approximately 250 drays would have been necessary. The 400 tons of long-haul freight between main and substations located within a ten-mile zone could not have been so transported by reason of mileage limitations of horse-drawn vehicles. On the other hand, motor trucks could not be profitably utilized by reason of long delays in assembling shipments for loading and in the unloading discharge of same.

To meet this operating dilemma and make possible for the railroads the commercial cartage economies of motor trucks, the Motor Terminals Co. developed the equipment and system of operation which was ultimately universally adopted at Cincinnati. Briefly, this system consists of a plurality of interchangeable bodies, or unit containers, one for each movement demand at each station, electrically operated hoists for the lifting and conveying of such bodies, and a limited fleet of motor truck chassis [fifteen in number with one spare] for the transportation of the bodies over city streets between stations.

A recent analysis of accomplishments disclosed the fact that all such freight interchanges have been expedited 52 hr.; that over 200 cars daily (70,000 annual car days, previously consumed in such service) have been released for main-line movements; that over 300,000 individual switch-cut movements of such cars have been eliminated to the extension of trackage rights for the movement of trains and groups of station cars; that station trackage capacity has been increased 21.4 per cent due to the elimination of trap cars; that station platform area enjoys an increase of approximately 15 per cent, and that total main station realty enjoys an otherwise unobtainable increase of 122,660 sq.ft.

Possibilities of Terminal Expansion

What has been accomplished at Cincinnati is but a meager demonstration of future possibilities. While only the stations of the railroads proper are now equipped for exclusive railroad movements, the service furnishes opportunity for extensions covering all intra-terminal movements to the complete elimination of the trap car, not only in railroad practice but in industrial practice, except for car loadings at sidings for dispatch to common or transfer points beyond the terminal proper.

The over accruing realty values adjacent to central terminals has been an influence to force larger industries into outer districts as soon as their volume shipments warranted siding facilities, and in each and every case the property vacated by these older concerns has been held at a premium. Constantly accruing influences of a short trucking haul for consignees and consignors have developed realty values adjacent to our main freight terminals, so centrally located, to the restriction of extensions. . . . Off-track or zone (motor-transfer) stations can be constructed within each terminal in lieu of physical rail extensions. The number of these off-track zone stations can be from time to time increased in ratio with the ever changing and ever increasing industrial development of each community. These zone stations, as common receiving and delivering points for all shippers and carriers, will ultimately develop warehousing or industrial centers. As commercial activities grow, the transfers to them from cars to truck bodies can be removed from the center of the cities to outer classification yards, thus releasing existing terminal rails for endless increasing carload movements, less all otherwise necessary investments for rail extensions.

Practical Store-Door Delivery

Of course, the natural evolution of this entire program is that of store-door deliveries, of which the railroads are wary, because they fear it will be harnessed on them at no increase in rates. This is but a contingent fear; not an operating dilemma. Under a properly created unit organization, operating in the joint interests of carrier and shipper, the cartage cost could be largely reduced. When industrial centers are thus equipped it requires no vision to conceive of the inter-city through dispatch, from store door to store door, of motor truck unit container bodies, utilizing the cheapest medium of transportation within its zone of most economical operation, viz., motor trucks, interurban cars, railroad flat cars, tow boats, lighters and steamers—without assessment for rehandling cost from each to the other, since the mechanical interchange can be accomplished at no labor assessment and with but minimum delay.

[An article describing the operation of the motor truck system of handling transfer freight at Cincinnati, together with editorial comment, appeared in *Engineering News-Record*, Mar. 11, 1920, pp. 498 and 508.—Editor.]

Engineering Features of the St. Lawrence Waterway

What the Proposed Great Lakes to the Ocean Route Means in the Way of Construction—Preliminary Outline of Work To Be Done

UNDER the provisions of the last River and Harbors Act the United States is co-operating with Canada in the engineering investigation of a proposed deep waterway connecting the Great Lakes with the ocean by way of the St. Lawrence River. For this country Col. W. P. Wooton, Corps of Engineers, U. S. A., is in charge of the studies and for Canada W. F. Bowden, Chief Engineer of the Department of Railways and Canals. The report is not expected until next spring and until it does appear it is doubtful if a true examination of the possibilities and difficulties of the scheme can be made but it is possible to outline the physical conditions which must be overcome, so that engineers may have an idea of the extent of the work. Costs and possible service must await a more thorough official investigation.

In an address before the Western Society of Engineers, Maj. John C. H. Lee, Corps of Engineers, U. S. A., recently gave a succint outline of the engineering requirements of the waterway. From that address the following extracts are taken; the accompanying maps have been prepared by this journal.

Conditions in Great Lakes

The Great Lakes generally are navigable for vessels of 21 ft. draft. The principal ports have been dredged to this depth, but between the various lakes of different level there exist certain natural barriers, which for the most part have been overcome.

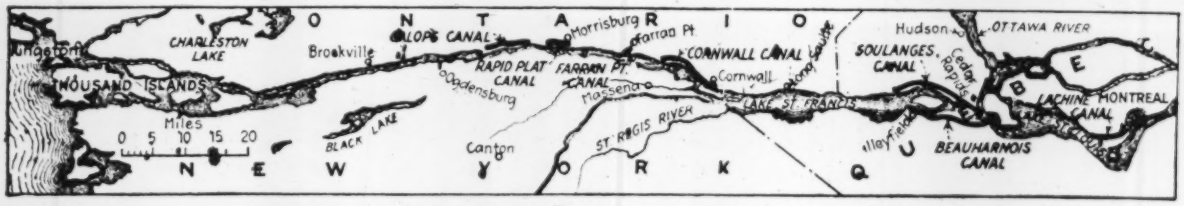
Between Lake Superior and Lake Huron there are the unnavigable St. Marys Rapids tumbling down a fall of 17 to 21 ft., depending upon the stage. The Canadians put in the first lock in 1797-8. In 1853-5 the United States put in its first "State Canal" then the Weitzel Lock in 1870-81. And the Poe Lock of 800 x 100 ft. area and 18 ft. depth in 1887-96. Then Locks 3 and 4 were built in 1908-14 and 1913-19 with dimensions of 1,350 x 80 ft. and a 24½ ft. depth. Meantime in the Canadian side that Government put in its lock of 900 x 60 ft. and 18.2 ft. deep in 1888-95. These take care of the Superior-Huron barrier.

Between Lakes Michigan and Huron there exists a good navigable channel with practically no change in level. Connecting Lake Huron with Lake Erie there is the St. Clair River, a naturally navigable stream except in the lower delta where dredging has been required; then the broad and rather shallow Lake St. Clair through which a good channel has been dredged; and finally the Detroit River to Lake Huron. Through the solid rock bottom of the Detroit River the United States has excavated an excellent channel so that up-bound vessels can draw 20 ft. at low water while down-bound vessels can have 21 ft. For normal stages these depths are 3 ft. better.

Between Lakes Erie and Ontario stands the greatest single barrier—Niagara Falls and the rapids, giving a difference of level of some 325 ft. The American Government has never put in a waterway around this barrier. The state of New York has its barge canal, 12 ft. depth via Rochester and Oneida Lake to Troy on the Hudson. The Canadians, however, have had the Welland Canal, with 25 locks (255 x 45 ft.) affording 14 ft. navigation since 1887. In 1913 they started a project to deepen this canal to 25 ft. with seven locks of 800 x 80 ft. and 46½ ft. lift with 30 ft. in the sills. Due to the war this was discontinued in 1916 with the project about one-third completed. The task was resumed last year and can be finished without difficulty by the time any through channel of equivalent capacity can be completed along the St. Lawrence route below Lake Ontario.

Below Lake Ontario

The barriers below Lake Ontario consist of the rapids of the St. Lawrence River between Ogdensburg and Montreal. Parts of this stretch are navigable. The Canadian Government has for years been operating a series of ship canals giving 14 ft. navigation around the different rapids. Some of the rapids are navigated by down-bound vessels, but up-bound vessels must use the canals. In this section lies the crux of the problem—deep water navigation from the Lakes to the Sea. Below Montreal the Canadians have already provided 30 ft. open river navigation to the Atlantic.



THE ST. LAWRENCE RIVER FROM LAKE ONTARIO TO MONTREAL

It is of interest to look at those characteristics of the St. Lawrence already of record, the better to understand the problem that confronts our engineers. The river's tributaries, above Lake St. Louis, where it is joined by the Ottawa River, are relatively insignificant. Its water, therefore, having been subjected to long periods of sedimentation in the various lakes, is clear and carries practically no matter in suspension. Its flow is governed by the elevation of water in Lake Ontario. As that lake has an extreme fluctuation of about 5 ft. and an ordinary annual fluctuation of very much less, the St. Lawrence naturally has a remarkably steady flow. No other river of its size compares with it in this respect. Its flow varies ordinarily from 200,000 to 280,000 cu.ft. per sec. although during the period 1888-1919 it has at times dropped as low as 186,000 due to a certain amount of ice choking. During extreme high water it has once or twice reached 300,000. Its lack of material in suspension, its constancy of flow, the stiff and stable quality of the material through which it flows, combine to render its banks and bed remarkably constant. Natural changes within the memory of man are practically unheard of.

Just above Montreal, in Lake St. Louis, the Ottawa River offers an additional problem. This stream has a very wide fluctuation, reaching a discharge in high water approximately equal to that of the main river. However, this condition only affects the lower end of the stretch requiring improvement. It is practically a local problem.

The river distance from Lake Ontario to Montreal is about 182 miles and the total fall is between 220 and 225 ft. Considering that there are several long broad reaches approximately lakes, it is evident from even a cursory examination that this portion of the river naturally divides

itself into several sections of quite different local characteristics, each requiring special study and consideration and each possibly requiring its own special method of improvement.

The Lakes to Lake St. Francis

The first section extends from Lake Ontario to just below Ogdensburg, N. Y. The total fall in this 62 miles is less than one foot. As one would expect, the river is broad and deep, and the velocity is low. The channel gives depths of 120 to 40 ft. Except in two places the width is better than 500 ft. Where it passes the Thousand Islands and again at the Brockville Islands, the present ship channel is only a little wider than 400 ft. and would probably require a little work. For security of deep draft vessels, this stretch should be "swept" in order to locate isolated pinnacles which may have escaped the soundings of previous surveys.

The second section extends from below Ogdensburg to the head of Lake St. Francis, or where the St. Regis river comes in at the international boundary. From this point on the St. Lawrence flows entirely in Canadian territory. The length of this second section is about 54 miles and its fall is about 90 ft. Three rapids account for the greater part of this drop. Just below Ogdensburg occur the Galops Rapids, about 10 ft. fall; near Morrisburg is the Rapid Plat of about 12 ft. drop; just above Cornwall is the Long Saulte with about 40 ft. fall. The remaining fall is found along flatter slopes adjacent to three rapids.

THE GREAT LAKE DISTRICT SERVED BY A ST. LAWRENCE CANALIZATION

The Canadian Government operates side canals affording 14 ft. navigation around these various rapids. The Galops canal takes care of the rapids of the same name. The Morrisburg canal overcomes the Rapid Plat. The Ferrin Point canal provides passage around a small drop of 4 ft. The Cornwall canal takes care of the Long Saulte. Otherwise vessels use the open river. Descending vessels habitually shoot all rapids except the Long Saulte. This rapid is navigated only by passenger boats featuring excitement of the trip.

This second stretch offers quite a problem for improvement. Dams and slack water can hardly be recommended for the entire section because sufficient water to flood out the upper (Galops) rapids would raise the level of the upper river and Lake Ontario something like 15 ft. It would seem after brief study that dredging would be practicable in the upper Galops provided the lower part is drowned out by slack water backed up by a dam further down stream. If dredging here were resorted to, care will have to be taken to provide a sufficiently large cross section to keep down the velocities in the ship channel.

It would seem that a dam in the general vicinity of Cornwall and possibly another somewhere above would provide sufficient depth for navigation while affording the development of well over a million horsepower.

It is understood that a commercial project was at one time planned for a power dam near the head of Croil Island. Our engineers have made borings above Cornwall, as well, and have found rock at what might seem to be desirable elevations. The solution of the problem must of course be based on a balance of costs against the facilities developed. If the rock for the foundations of the upper dam is found at about the same elevation as at the lower site, then a single dam project would probably have an advantage in cost of dam construction, cost of power installation and better provision for navigation. The flowage damage or cost of dikes would be increased only between the two sites.

Realizing that the power developed at this section of the river could be delivered to the greater part of New England and New York there should be no difficulty in disposing of it at a figure sufficient not only to pay interest on the investment but also on other work of the same project, if not indeed giving finally a return on the original investment.

Lake St. Francis Section

The third section may be taken as Lake St. Francis, where for some 28 miles the river widens to four or five miles. In some places the channel will require widening and deepening. There is no apparent reason why open lake navigation cannot be provided for ocean going craft at a low cost.

The fourth section is a stretch of 14 miles connecting Lake St. Francis with Lake St. Louis. In this length are a series of rapids; the Coteau, the Cedars, the Split Rock and the Cascade—a total fall of about 80 ft. At present a few down stream boats "shoot" the rapids. The Soulanges canal provides 14 ft. navigation on the northern side. The old Beauarnois canal lies on the southern side.

This section offers a problem similar to the second but probably with not as many factors. Judging from their practice in the past we can expect the Canadians to consider seriously, if indeed not to favor, ship canals around the rapids. A cursory examination would indicate that such a plan is practicable on the southern side. If no great obstacles are encountered such a project should be considerably cheaper than a fixed dam and slack water. Moreover, it is possible that if a fixed dam developing the full power head were installed and power put on the market at the same time as that of section two, there would be little chance of complete utilization for several years. If this is true, if the power could not be immediately marketed, it might prove economical to provide the cheaper ship canal for the first decade or so, and later, if conditions seem to justify, make provisions for further development of power.

There are apparently good general locations for a dam in one or two sections at the head of Lake St. Louis, just above the mouth of the Ottawa River.

Lake St. Louis to Montreal

The fifth section is Lake St. Louis—15 miles long and rather shallow through the greater part of its 5 to 6 mile width. There exists, however, a fairly good channel which will require deepening and broadening at least in parts. Due to the influence of the Ottawa River whose variation in flow is quite large, the characteristics of the St. Lawrence below this point are less constant than above.

The sixth section is 9 miles of river between Lake St. Louis and Montreal. The river pitches down the Lachine Rapids, thence through the Prairie Basin, a broad and shallow lake with low banks. The total fall is about 50 ft. most of it confined to the Lachine Rapids which are navigated only by a few down-bound passenger boats. The Lachine canal passes around them on the northern side, affording 14-ft. navigation. The improvement of this stretch

is a problem in which the Canadian engineers can be expected to have most serious interest. Safeguarding the city of Montreal against the combined waters of the St. Lawrence and the Ottawa will play an important part. A power dam opposite or below Montreal, near the mouth of the present Lachine canal, would require long dikes or levees to protect the city. Moreover, due to the low lying banks, a great flowage or very extensive dike construction would be required on the southern side. This expense coupled with the unreliability of the Ottawa River's discharge would probably cause considerable opposition in the vicinity of Montreal. Moreover, it is understood that practically the only open opposition to the project in Canada is centered around Montreal, the present head of deep-water navigation.

It seems not improbable therefore to expect that some project such as the improving of the existing Lachine canal would be seriously considered. If power is to be developed further it will probably have to be located above Prairie Basin at the foot of the main rapids. If navigation were locked past such a dam, there would remain the shallow Prairie Basin to be considered. The Basin has sufficient slope to make dredging through it a perhaps double task. As in the Galops Rapids of Section 2, if a single 600 ft. channel 30 ft. deep were cut through, hydraulic conditions would be so improved as to develop velocities probably beyond those desirable for navigation. Either additional cross section should be dredged, or the adjacent water kept out by a dike, thrown up from the spoiled material which would be mainly rock.

This brings us to the head of existing 30-ft. navigation to the sea. The Canadian Government has now provided at considerable expense a good sailing channel through which some 4,000,000 tons per season come up and go on through the cramped upper canals, before mentioned, whose locks are only 225 x 45 ft. by 14 ft. dept. The river and canals are usually open to navigation from the middle of April to the first third of December. During the winter and early spring ice closes the route.

Thus we see confronting the engineers and the commission six sections of river, three of which offer little or no difficulty. The upper river and the two "lake" reaches. There remain three stretches of rapids requiring individual study and investigation. Possibly they will require separate and different treatment.

The engineers are confronted with several interesting problems. One of the first is the regulation of water flow in the river by the control of water level in Lake Ontario. A steady flow of large volume is desired in the river, yet a maximum and minimum level must not be passed in the lake. Naturally the property owners on Lake Ontario do not want to be flooded, nor yet left high and dry. The power and navigation interests along the river can't have a perfectly steady flow but it should be possible to guarantee them a minimum of about 200,000 cu.ft. per sec. without detriment to Lake Ontario interests.

Another problem is that of ice. The Canadian engineers largely, and our own to a more limited extent, have been working on the problem for years. Ice packs and gorges with their attendant high water often cause great concern, but the river has a way of working under the ice and freeing itself. The engineers admit that the problem is extremely "interesting" but there is no indication that they think it insurmountable.

The construction of dams in the main river bed should prove an engaging task to the men who may have to do the field work. The choice of dam sites has to be governed somewhat by this consideration. There is no way of shutting off the water during the working season. The flow is then distressingly steady. There is no "low water" as on the Ohio or the Mississippi. The task, if undertaken, must clearly be considered in its entirety; otherwise great difficulty if not disaster, may result to construction work, due to damming below or dredging above.

The economical feasibility of developing the full available hydro-electric power opens a serious question. Between Lake Ontario and Montreal the total theoretical horsepower is readily computed as over 6,000,000. Due to the unusually stable characteristics of the river it seems fair to assume that with a machine efficiency of 90 per cent, at least 75 per cent of the theoretical horsepower is possible of development; i.e., 4,500,000 hp. Whether or not this amount should be made available from the start, or be provided for at an increasing rate, is a problem of industrial economics.

At the present time only about 200,000 hp. is actually being developed. Most of this is at two plants, one at Massena, N. Y., and the other at the Cedar Rapids between Lake St. Francis and Lake St. Louis. Plans for damming the river at the Long Saulte Rapids were prepared by the Long Saulte Development Co. over ten years ago and effort made to obtain the necessary authority from the Canadian and United States Governments. The matter failed to get the necessary legislative approval and the project was abandoned. It is of interest to know that the development of power, not considering the benefit to the country through navigation has been considered practicable and worthy of financial enterprise. Such schemes of course included provisions for passing navigation by locks, as the Keokuk on the Mississippi, but the power company which was willing to finance the matter was to derive little direct benefit from the improvement to navigation.

Pennsylvania Registers 600,723 Vehicles

Figures recently made public by the Pennsylvania State Highway Department show that a total of 1,069,603 1920 licenses of all sorts, and 600,723 registration plates were issued up to Sept. 11. The figures show that there was an increase in almost all classes of registrations. Comparative tables are as follows:

Registration plates:	1920	1919
Passenger cars	507,622	429,001
Commercial vehicles	50,226	40,406
Tractors and traction engines	3,160	3,328
Trailers	839	1,291
Motorcycles	23,510	25,123
Motor vehicle dealers	13,761	9,935
Tractor dealers	231	188
Motorcycle dealers	241	*
Bicycles with motor attached	1,128	*
Total	600,723	509,272
Licenses Issued:		
Motor vehicle licenses, all kinds	600,723	509,272
Paid drivers	114,345	82,343
Licensed operators	128,291	146,282
Tractor drivers	368	*
Transfer of licenses	40,736	31,463
Special operators	466	*
Learner's permit	2,487	*
Vendee affidavits second-hand cars	180,653	16,344
Dealers in used motor vehicles	1,534	951
Total	1,069,603	786,590

* Classifications as required by new motor law after Jan. 1, 1920.

The decrease in the number of licensed operators is attributed to the fact that all owners of motor vehicles are now given an operator's license free of charge, while persons not owners pay a fee. Department officials are unable to explain the apparent decrease in the number of motorcycles during 1920. There is also a decrease of traction engines and trailers.

That many automobiles change hands during the course of the year is evidenced by the large number of vendee affidavits issued. The law compelling the filing of affidavits relative to second-hand cars was not in effect during all of 1919.

Railway Water Supply at Atkins, Iowa

An inaccurate title was given to the illustration in the article in *Engineering News-Record* of Sept. 2, p. 463, owing to the omission of a cut. The title should have read "Test of Surge Pressure in Pipe Line." The testing of the pipe line was done in lengths of 1,000 instead of 100 ft. The author is assistant engineer of the Chicago, Milwaukee & St. Paul Ry.

Report on a Tentative Zoning Plan for Lakewood, Ohio

Six Use, Four Height and Four Area Districts Provided with Height and Area Districts Superimposed On Use Districts—All Three Classes of Districts Shown on Single Map

By Robert H. Whitten
City Planner, Cleveland, Ohio

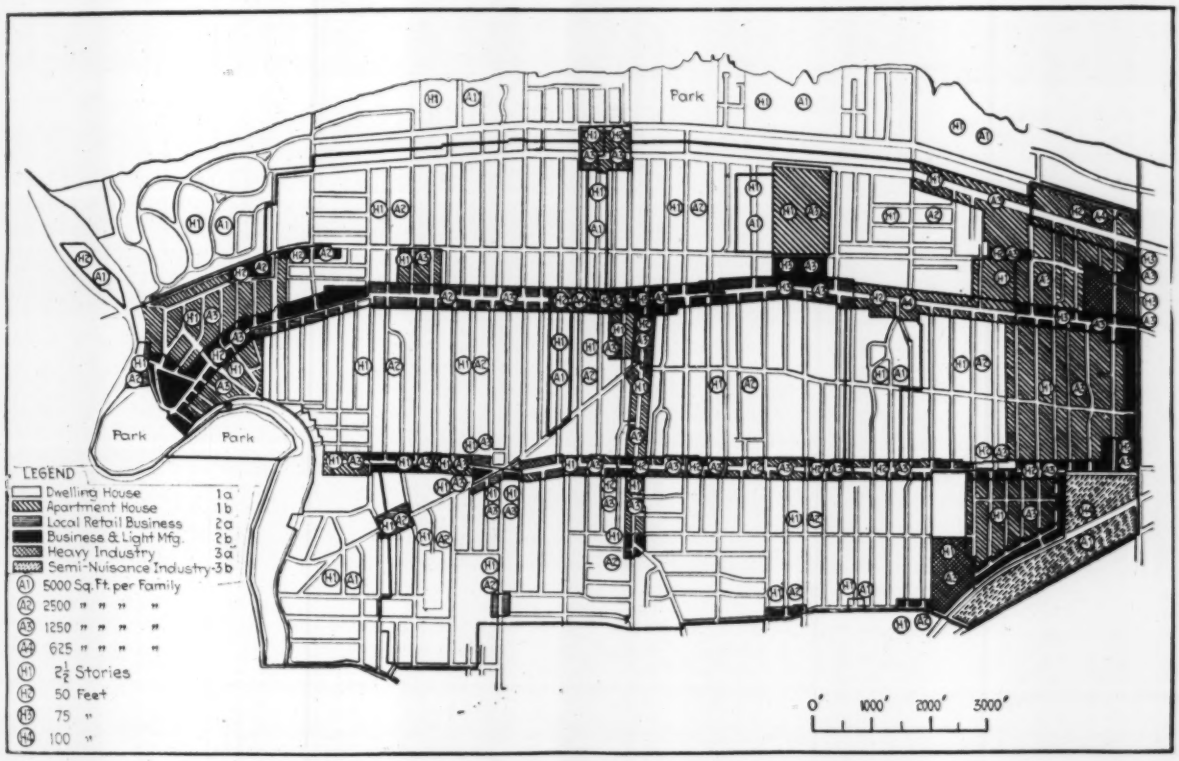
Except for local allusions to streets and avenues, Mr. Whitten's report on zoning for Lakewood, Ohio, is reprinted in full as a clear exposition of zoning principles applicable to many other communities of the same general character. This zoning scheme, Mr. Whitten states, has for one of its main purposes the preservation of Lakewood as a city of homes.—Editor.

THE city of Lakewood is divided into six classes of use districts. Two of these are residence districts and four are business and industrial districts. In addition to the use districts there are four classes of height districts and four classes of area districts. The height and area districts are superimposed over the use districts. Consequently each portion of the city is in some one of the six classes of use districts. In some one of the four classes of height districts and also in some one of the four classes of area districts. The boundaries of the various use, height and area districts are shown on the zone map.

1. *Residence Districts*—The two classes of residence districts are (1) Class 1a or dwelling house district. (2) Class 1b or apartment house district. A building arranged for more than two families may not be constructed in a dwelling house district.

One of the chief purposes of the zone plan is to preserve Lakewood as a city of homes. While a certain number of apartment houses are beneficial, they should not be allowed to drive out the private homes. Carefully limited but adequate areas are allowed for apartment house development. The dwelling house districts, permitting the erection of either one- or two-family dwellings but excluding apartment houses, will include a very large proportion of the entire area of Lakewood.

The residence zoning is supplemented by the area district regulations that limit the number of families that may be housed on a given plot of ground and also limit the percentage of lot that may be covered. The area zoning regulations also require side and rear yards for all buildings located within residence districts, whether they are dwellings, apartment houses, churches, schools or other authorized uses. Uniform building lines back from the street line are also prescribed.



MAP SHOWING TENTATIVE ZONING PLAN FOR LAKEWOOD, OHIO

The residence district regulations are also supplemented by the height district regulations. A given residence district may be combined now with one and now with another of the various height and area district classes. The dwelling house (class 1a) districts will usually be placed in the class H-1 height district which limits height to 2½ stories. Other apartment house areas on the side streets will be in the H-1 height district limiting height to 2½ stories.

Trade and industry are excluded from the residence districts. Churches, schools, hospitals, philanthropic institutions, clubs and hotels are permitted in the apartment house district, and with certain important limitations as to location, these uses with the exception of the hotel are permitted in the dwelling house district.

2. *Business and Industrial Districts*—There are four classes of business and industrial districts: (1) Class 2a or local retail buiness district. (2) Class 2b or business and light manufacturing district. (3) Class 3a or heavy industry district. (4) Class 3b or semi-nuisance industry district. The purpose of this classification is to provide locations for all the types of business and industrial use with a minimum of inconvenience and waste and a maximum of efficiency. It is not only necessary to protect the residence sections from invasion by all kinds of trade and industry but also to protect certain kinds of trade and industry from being injured by proximity to antagonistic or deleterious types. A manufacturer of food preparations may be seriously injured by the location nearby of a fertilizer plant. Moreover certain types of business and industrial use may be located close to good residential sections without material injury while other types if located within a quarter of a mile of such sections are a distinct nuisance. It is only by carefully grading the various trade and industrial uses according to their comparative freedom from nuisance characteristics that an orderly and efficient development of the city may be secured.

In the local retail business (class 2a) district, retail trade, offices and small shops for custom work or for the making of articles to be sold at retail on the premises are permitted. The uses permitted in the residence districts are also permitted in the local retail business district. Public garages, light manufacturing and bulk storage are excluded from the local retail business district. This district is suitable chiefly for the smaller retail centers adjacent to the residential sections.

The business and light manufacturing district regulations permit, in addition to all uses permitted in the local retail business district, all kinds of light manufacturing of a non-nuisance character and also public garages, bulk storage and wholesale business.

In the heavy industry (class 3a) district all heavy industrial uses of a comparatively non-nuisance type are permitted in addition to all the uses permitted in the residence and business districts.

In the semi-nuisance industrial (class 3b) district such uses as boiler making, structural iron works, junk storage or carbon works are permitted. The nuisance uses that affect a very wide area such as fertilizer plants, glue manufacture, stock yards or slaughter houses will be excluded from the limits of the City of Lakewood.

The zoning regulations also provide that such special uses as a cemetery, crematory, aviation field or sewage disposal plant may be located only on application to and with the approval of the city council.

3. *Height Districts*—The entire city is divided into four classes of height districts, with maximum height limits as follows: (1) Class H-1, 2½ stories. (2) Class H-2, 50 ft. (3) Class H-3, 75 ft. (4) Class H-4, 100 ft. The height districts are superimposed over the use and area districts. The height regulations, in addition to imposing a maximum height limit for each district, also regulate the height of a building with relation to the distance of the front wall of the building from the center line of the street. The ratio of the building height to the distance of the front wall of the building from the center line of the street is 1 time in the H-1 district, 1½ times in the H-2 district and H-3 district and 2 times in the H-4 district. The limitation of height with reference to the distance of the buildings from the center line of the street adopts the offset principle of permitting a building to be erected at the street line to a certain height, and then to be built higher provided it is set back in a prescribed ratio. For example, in the class H-4 district, where the height limit is 100 ft., a building on an 80-ft. street may be erected at the street line to a height of two times the distance of the building from the center line of the street, or 80 ft., and then by setting back 10 ft. may go 20 ft. higher or the maximum of 100 feet.

The class H-1 height district, with a 2½-story limit, will be applied in most of the residence sections of the city other than certain apartment house frontages on Clifton Boulevard, Detroit Avenue and Madison Avenue.

4. *Area Districts*—The entire city is divided into four classes of area districts, according to required lot area per family, as follows: (1) Class A-1, 5,000 sq.ft.; (2) Class A-2, 2,500 sq.ft.; (3) Class A-3, 1,250 sq.ft.; (4) Class A-4, 625 sq.ft.

The area districts are superimposed over the use and height districts. The area district regulations are intended to promote an appropriate distribution of population and to resist the tendency toward the congestion of population. They are also intended to secure a more open residential development by limiting the percentage of lot that may be covered by buildings in residence districts.

The regulation as to the number of square feet of lot area is based on the number of housekeeping units or families for which the building is arranged or designed. In computing the lot area for this purpose, the area opposite the lot to the center of the street is included. This permits a somewhat more intensive development on the wider streets and on the corner lots. On a street 50 ft. wide, for example, a lot 40 x 100 ft. can be improved with a single-family house in a class A-1 district, a two-family house in a class A-2 district, a four-family house in a class A-3 district and an eight-family house in a class A-4 district.

The class A-1 district requiring 5,000 sq.ft. of lot area per family is applied in those sections of the city where the single family house is the most appropriate development. Two-family houses are not prohibited, but the two-family house would require 10,000 sq.ft. of lot area. This requirement as to lot area, and an additional requirement that not over 30 per cent of the area of the lot may be covered by the building, will in practice tend to limit the construction in class A-1 districts to single-family houses.

The residence sections that are generally appropriate for improvement with either one- or two-family houses will be placed in the class A-2 district, requiring 2,500 sq.ft. of lot area per family. In this district not more than 40 per cent of the area of the lot may be covered by the building.

Most of the apartment house districts will be in the class A-3 district, requiring 1,250 sq.ft. of lot area per family. Certain apartment house areas on Detroit Ave. and on Clifton Boulevard will be in the class A-4 area district requiring only 625 sq.ft. of lot area per family.

In computing the number of families that may be housed on a given lot area, deduction is made where a portion of the lot is used for business or industrial purposes. Thus in a class A-3 area district where four families might be housed on a 40 x 100-ft. lot, if there are two stores on the ground floor, the number of families that can be housed on the lot is reduced by two, or, to be exact, there is a reduction of one family for each 1,000 sq.ft. of lot area occupied for business purposes. The ordinary two- or three-story store and dwelling building is not a desirable type of construction from a public standpoint. The regulations as applied will tend to reduce the number of flats that would otherwise be located over stores.

5. *Yards; Building Lines*—Side yards and rear yards are required in all residence districts. As an exception to the side yard rule, a terrace of not to exceed six single-family dwellings may be built with side yards only on either side of such group of buildings. The width of the side yard shall not be less than one-sixth of the height of the building or not less than 4 ft. in any case. The width of the rear yard shall equal one-half of the height of the building. Forty per cent of the area of the rear yard may be occupied by one-story accessory buildings.

In business and industrial districts side yards are not required but rear yards, with certain important exceptions, are required. No rear yards are required in class 3b industrial districts. In class 3a industrial districts and in business districts rear yards are not required for corner buildings but are required on interior lots that are back to back.

The zone plan does not attempt to provide a complete code for the lighting and ventilation of the building. It simply establishes minimum standards for those open spaces about the building that have a relation to the lighting and ventilation of the adjoining buildings as well as to that of

the building itself. The zone regulations are thus confined to those things in which adjoining owners have a mutual interest. Side yard, rear yard and front yard spaces are required for the mutual advantage and protection of all owners and occupiers of the block. The provision or omission of an interior court, on the other hand, does not affect the neighbor.

Front Yards; Building Lines.—The zone plan establishes building lines on street frontages where an open space between the building and the street line is required in the public interest. These building lines, as shown in detail on a special building line map, are imposed generally throughout the residence districts and also where needed and existing conditions will permit in the business and industrial districts.

In certain business and industrial sections where it is highly desirable to secure a greater distance between buildings on the opposite sides of a street but where a number of existing buildings have been constructed out to the street line, the building line regulations will permit the erection of a one-story building or in some cases of a two-story building between the building line and the street line. This will permit a building to come out to the sidewalk line where otherwise it would be pocketed between existing buildings.

Lakewood has been generally developed with residences setting well back from the street line, affording adequate room for lawn and trees. This makes a healthful and convenient city as well as a beautiful city. Grass and trees make an attractive home environment and are almost essential to a normal and healthful development of the child.

The setting of the buildings back from the street line improves light and air conditions, makes possible the front lawn with trees and shade and removes the dwelling farther back from the noise, fumes and dust of the street. It increases the attractiveness of the section and adds to the health and comfort of the people.

Street widths throughout the city have generally been established on the supposition that buildings were to be set back from the street line. A street width of 40 or 50 ft. is entirely inadequate if residences or other buildings are to be built on the street line. The street is not only a traffic way but should serve the function of securing a more open development, better access of air and sunlight and a chance for trees and other vegetation. A certain minimum space between the buildings located on the opposite sides of a street is also essential to prevent the spread of fire and to facilitate fire fighting.

In order to improve light and air conditions, existing building regulations provide for rear yards. To a certain extent the same reasons hold good for the establishment of front yards. The requirement of a uniform building line means the establishment of a uniform front yard space.

6. *Classification of Uses.*—The classification of uses which is a part of the zoning ordinance divides the various uses of property into groups, classes and subdivisions. The use classes correspond to the use districts. Each use class lists the uses for which the corresponding use district class is specially designed to provide. Starting with the dwelling, the classification enumerates the various kinds of residential, business and industrial uses graded and arranged according to their comparative freedom from nuisance characteristics. In the hierarchy of uses the dwelling comes first and garbage reduction and fertilizer plants last.

7. *Non-Conforming Uses.*—The zoning ordinance does not affect existing uses of property. A use or building existing at the time of the passage of the zoning ordinance which does not comply with the regulations of the use district in which it is located is called a non-conforming use. Such use or building may be continued though not conforming to the use district regulations. The zoning ordinance is not retroactive. If, for example, there is a store in an area that under the zoning ordinance is included in a residence district the store may nevertheless be continued. A non-conforming use may also be changed, subject to the general rule that, if changed, it must be to a higher use as listed in the classification of uses. If, however, the non-conforming use is a Class 3b (semi-nuisance) use or 3c (nuisance) use, it may not be changed unless to a conforming use. A change to another use listed in the same subdivision of the classification is not deemed a change of use under the zoning ordinance. Thus a change from a grocery store to any other kind of a retail store or shop would technically be deemed a continuance of the existing use. A building housing a non-conforming use may not be structurally altered to an extent exceeding during any ten-year period 60 per cent of the assessed value of the building.

While, therefore, an existing non-conforming use may be continued, the limitations imposed on a change of use and on the reconstruction of the building housing the non-conforming use will eventually bring about the diminution of the non-conforming use.

8. *Enforcement; Board of Zoning Appeals.*—The zoning ordinance will be enforced by the inspector of buildings. No building permit will be issued unless the building and its proposed use conforms to the zoning regulations.

In the application of the zoning many cases will arise, especially near the dividing line between two use districts, where the strict letter of the zoning regulations may properly be modified. This can be done in specific cases without injury to the general public purposes of the ordinance while at the same time avoiding unnecessary injury to the individual owner. Strictly limited discretion is therefore lodged in the Board of Appeals created by the building code to make minor modifications and exceptions to the general rules and regulations established by the ordinance.

9. *Amendment of Zone Plan.*—The Council will have full power to amend or supplement the zoning plan. Minor changes will be necessary to correct imperfections in the plan. Other amendments will be required to meet changing conditions of city growth. It is to be expected that the plan will be supplemented and changed when certain fundamental factors affecting the physical structure of the city have been more fully worked out.

While provision should be made for necessary changes, the method of such change should be safeguarded so as to prevent hasty and ill-considered action. A zone plan, in order to afford the protection for which it is designed, should be fairly permanent. Those that build in accord with its provisions should feel reasonably sure that their investment will not be jeopardized by changes in the district lines. On the other hand, the method of change should not be so difficult as to make it impractical to conform the zone plan to changing conditions of city growth.

Under the zoning ordinance any amendment proposed must be referred by the City Council to the City Plan Commission and unless such amendment is approved by the commission, it will require a four-fifths vote of the council to pass the amendment. A similar four-fifths vote is required if there is a protest against the amendment, signed by the owners of 20 per cent of the land adversely affected by the proposed change. If an amendment is proposed by the petition of the owners of 50 per cent of the land in an area proposed to be changed the council must vote on the amendment within 90 days.

Toledo Water Purification Costs

The cost of treating the water supply of Toledo, Ohio, in 1919 was $16.90 per million gallons. Alum, iron, lime and chlorine cost $7.66, $4.46, $3.37 and $0.23 per million gallons, respectively. The average cost per ton of these chemicals was as follows: Alum, $31.85; iron, $17.60; hydrated lime, $14; chlorine, $193.52. Of the $156,912.72 total cost $5,000 was for supervision, $41,208.42 for labor; $67,340.67 for chemicals, $5,107.36 for maintenance and the remainder for miscellaneous items. Average results in B. Coli content per 100 cu.cm. were as follows: River water, 2,319; settled water, 60; filtered water, 16; disinfected water, 1.7; city tap water, 0.42, equivalent to 99.98 per cent removal by the whole process.

Municipal Milk Plant for Jamestown

BONDS to the amount of $150,000 and the creation of a milk commission to establish a milk bottling and pasteurization plant and a milk distribution system for Jamestown, N. Y., were authorized by a large majority at a popular election held on Aug. 21. The commission will consist of four members to be appointed by Samuel A. Carlson, mayor of Jamestown, who for several years past has been working for the municipalization of the milk supply of Jamestown. A similar proposal was defeated by a large majority a year ago. In a letter to *The American City* Mayor Carlson outlines the municipal milk project as follows:

The plan contemplates the erection of a central station to which all milk from the producer will be brought and tested in a scientific manner, each can from each producer being subjected to an individual test so as to safeguard against bacteria and impure milk. The producer will be paid on the basis of the quality of milk supplied; those having the lowest bacteria count and highest percentage of butter fat will receive the highest price for milk. The milk will be clarified and all milk except Grade "A" raw milk, which comes from tuberculin tested cows, will be pasteurized, and all milk will be placed in bottles under the improved method of bottling, under which the milk is free from the touch of human hands or any contamination. The milk will be delivered at an early hour to each householder. The city will be divided into 30 districts, one delivery man for each district. These 30 men will take the place of the 70 milk peddlers who are now supplying the city with milk, and who are crossing each other's tracks continually and thereby entailing a duplicate expense and waste of effort, which is now borne by the community. The municipal system will eliminate the added cost of the present middleman's profit.

Mayor Carlson states that it is expected that the city will be able to sell milk below the present price of 15c. per quart for Grade "B" quality, besides giving a better and richer milk and affording the farmer a higher price. He also says that the municipal milk project is designed to promote health rather than economy. He states that the milk supply for the 40,000 people in Jamestown costs them more than $1,000,000 in a year, or 60 per cent more than the entire municipal tax budget. He also says that the city expects to produce cheese, butter and buttermilk at its bottling plant.

Enormous Rainfall in Hawaii

An inch a day is the average rainfall in the upper Waipio Valley, Hawaii, which makes it one of the areas in the world where the rainfall is heaviest. On the other hand, the rainfall on some of the slopes of Hualalai, on the same island, is only 20 in. a year. The only surface streams on the island are along the northeast coast between Hilo and Kohala. Waipio River, according to the U. S. Geological Survey, has been partly developed for irrigation.

Hydraulicking Methods for a Million Yard Fill

Single Dredge Places Blanket of Clean Lake Sand Over 65 Acres of Marsh Land for a Factory Site

UPWARDS of 100,000 cu.yd. of sand each month is being pumped by a 15-in. hydraulic dredge in making a fill for a factory site at Waukegan, Ill. About 12½ per cent solids are being averaged and at times the proportion has reached 27 per cent. The greatest length of discharge has been 4,700 ft. and later this length will be increased to about 5,000 ft. The fill is clean lake sand to a depth of 6 to 16 ft., with terraced plateaus about 4 ft. higher for the building sites, over an area of about 65 acres, and will amount, it is estimated, to 1,000,000 cu.yd.

As a hydraulic fill operation the work is notable in

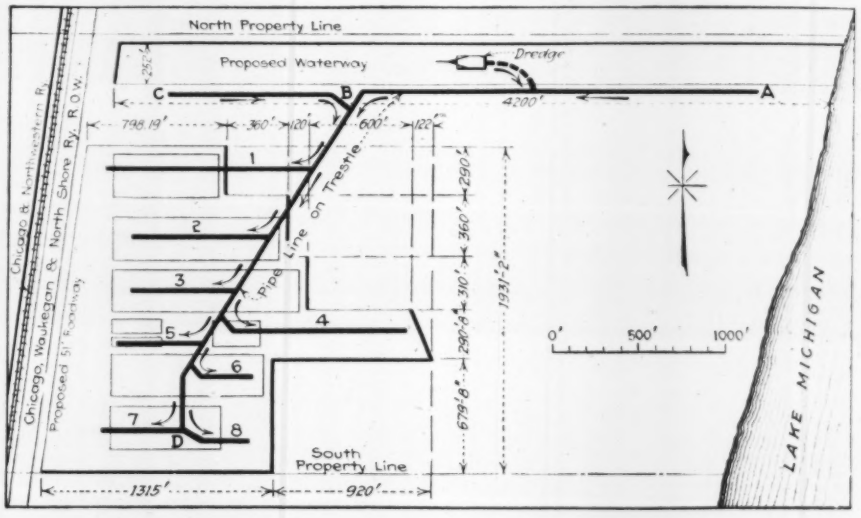


FIG. 1. LOCATION OF FILL AND PIPE LINES

the particulars that (1) it is the largest fill specified to be entirely clean sand, ever made by hydraulic dredge, (2) the distance pumped, without a booster pump, is the greatest ever accomplished in pumping sand, (3) the building areas are terraced above the general fill level and pits, with regular slopes, are left below this level, by water control of the flowing sand, (4) the total lift is accomplished close to the dredge by a steep incline to a pipe on a trestle which constanly descends on a detemined grade to the point of discharge, and (5) the jet pump is connected with the discharge pipe in such a manner that, with the arrangement of discharge just indicated, plugs in the pipe lines are washed out without taking the pipe apart.

As indicated by Fig. 1, the fill covers an irregular area of about 65 acres at the west end of a quadrilateral tract fronting about one-half mile on Lake Michigan. This land, being a part of the old lake beach, is, except for a shallow covering of marsh muck, a fine beach sand, with few pebbles and is free from obstacles to excavation other than the long roots of the marsh plants which tangle into knots and frequently choke the mouth of the suction pipe. A channel 250 ft. wide and 4,200 ft. long, parallel to the north property line, provides the material for the fill. The main fill is to

El. 99.5 or to about 8.5 ft. above lake level, and varies, with the contour of the original surface, from 6 to 16 ft. in depth. At the sites of the building, the foundation fill is 3 to 9 in. above the main fill. Railway tracks and roadways occupy the depressed areas between buildings. A section across the filled area, transversely of the buildings, has the character of a series of wide plateaus separated by narrow valleys and to secure this variation of surface with water-borne sand was one of the special problems of the operation.

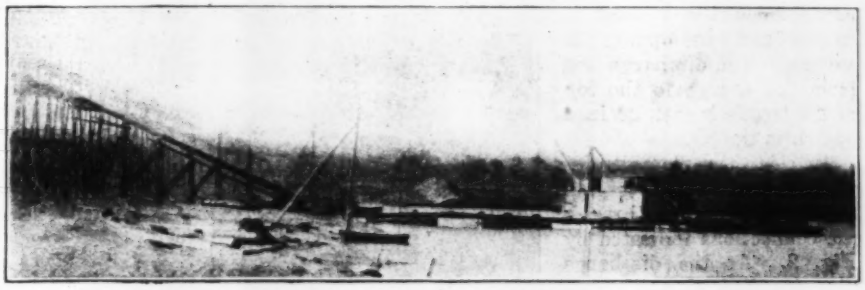


FIG. 3. TOTAL RISE IN PIPE LINE KEPT CLOSE TO DREDGE

Both the sequence of excavation and fill and the discharge pipe location were definitely planned. Starting the dredge at about midlength of the channel it was planned to work west to make the southern portion of the fill and east to make the northern portion. This plan kept the average length of discharge pipe about the same for the two portions of the fill. The pipe line consisted of a trunk line *A* to *B* to *C* and *B* to *D*, located as shown, with branch lines Nos. 1 to 8 right and left and longitudinally of every building site. Broadly speaking that portion *BD* of the trunk line across the filled area is permanent while the portion parallel to the channel is installed and shifted as the dredge location requires. The branch lines are installed, shifted and extended as the filling progresses.

In portions of its equipment the dredge is unusual. As indicated by the diagram plans Fig. 2, the dredge pump is a 15-in. centrifugal, set vertical and operated at 440 r.p.m. by a direct connected 600-kw. motor. Its discharge pipe take-off is unusual in the respect that it is arranged to receive a stream from the jet pump the purpose of which is to clear the discharge pipe line from plugs in the manner which is described later. The jet pump has an 8-in. suction and a 6-in. discharge and gives a pressure of 75 lb. Electrical equipment, suction pipe control and other mechanism are of ordinary types.

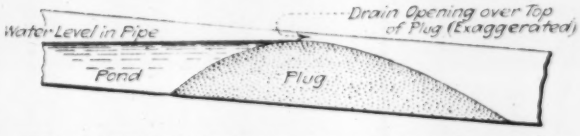


FIG. 4. METHOD OF CLEARING PLUGS IN PIPE LINE

From the dredge the discharge is horiztonal, as indicated by Fig. 3, to the edge of the channel, and then climbs in one step to the peak lift, which is the trunk pipe line on trestle paralleling the channel. This trestle is about 30 ft. high along the channel bank and then slopes down from *B* to *D* and to the ends of the branches, but all pipe line is on trestle and is laid true to line and grade. This accurate construction of pipe line, with the concentration of the total lift in the short distance between the dredge suction and the channel bank trestle and the discharge line on a constantly descending grade from the trestle top to the discharge end, is the special feature of the pipe line layout.

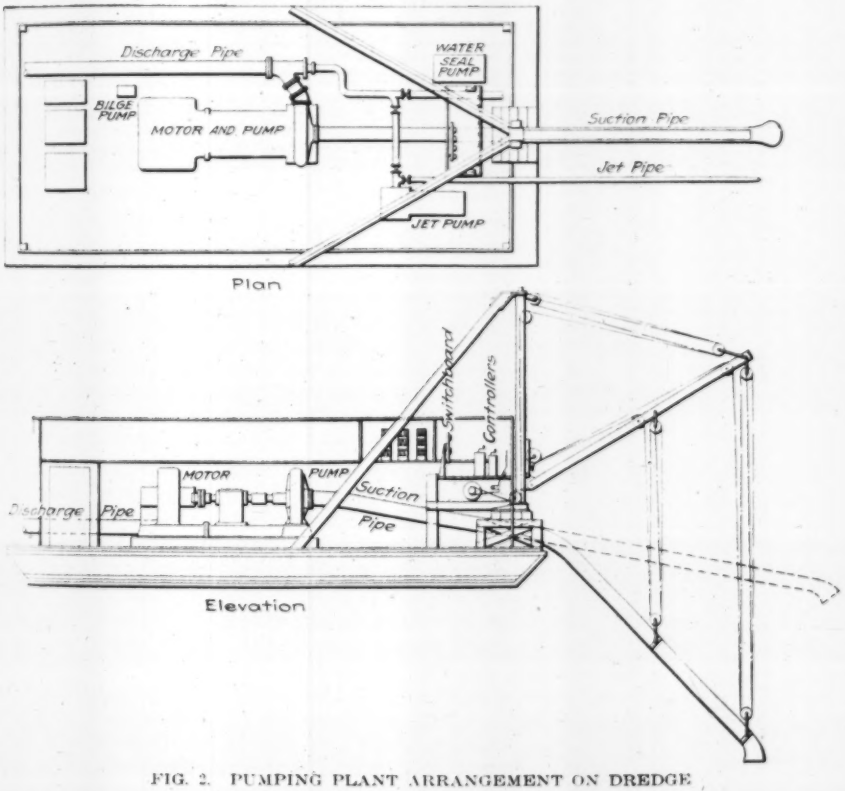


FIG. 2. PUMPING PLANT ARRANGEMENT ON DREDGE

An important purpose of the constantly descending grade of the discharge pipe line is to remove plugs. A plug forms as indicated by the sketch Fig. 4, but unless a careless pump man keeps driving ahead with a full load of solids, it does not form so solidly that there is not always, due to the inclination of the pipe, a small rill or trickle of the backed up water over the top which leaves a passage open. As soon, then, as the pump man's gages indicate that an incipient plug

has formed the suction is raised and the pump is stopped. The discharge line from the dredge to the top of the trestle is then drained back into the pit.

To clear the plug the jet pump starts pumping into the discharge pipe through the connections indicated by Fig. 2. As the discharge pipe is filled, the water in the pond behind the plug, as shown by Fig. 4, begins to rise and trickle through the small channel over the top of the plug and with increasing pressure from the jet pump the flowing rill accumulates an eroding velocity which enlarges the channel and cuts down the crest of the plug. When the water is flowing freely, the main pump, taking clear water, is started and the sand is flushed through and the pipe cleaned out.

With this arrangement there has not been a plug in these long discharge lines which has not been cleared in 40 min., except once when a chance was taken of extending a branch pipe line on the top of the fill and a plug occurred which necessitated the removal of the plugged pipe and many profane hours of picking and washing. A plug of fine beach sand is very hard. It cannot be shaken out by upending the pipe nor can it be punched through with bars. It is best removed by tilting the pipe and hosing from the low end.

FIG. 5. LEVEED BASIN READY FOR FILL

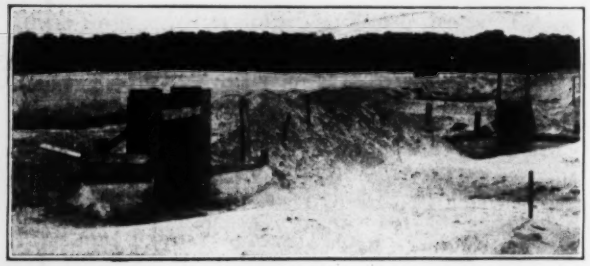


FIG. 6. OVERFLOW OUTLETS THROUGH LEVEES

From the dredge to the trunk pipe line on trestle the discharge pipe is 15 in.; the trunk line and laterals are '8 in. to reduce friction. A lock joint spiral pipe is used, with flanged ends and bolted pipe joints. The stream velocity is 12 ft. a second and about 12½ per cent, average, of solids is carried, practically all in the lower third of the stream.

FIG. 7. METHOD OF LEVELING UP FILLS

The rectangular fills are built up as indicated by Fig. 5, with levees built by a walking dragline excavator. Timber outlets of the familiar L-shape take the overflow through the levees as indicated by Fig. 6. As the fill is made the sand takes a slope right and left from the pipe toward the levees. To flatten out this slope as from *CA* to *CB* in Fig. 7, a trench is dug and a low levee built as indicated. The face of this levee is protected by convass weighted down. As the grade near the levee builds up the wier level of the L-outlet is raised. To go higher than *CB* another ditch is dug and a levee built and the canvass is folded back to protect the new levee face. In this way the 4-ft. building site fills were carried above the level of the main fill and the top surface created, by water cariage alone, did not vary to exceed 1 per cent from true level.

Operating two shifts, the dredge has been pumping over 100,000 cu.yd. a month. This excellent output is due in part to the efficiency of the crews which is being promoted by bonus payments. If the crews reach a monthly yardage of 100,000, each man receives as bonus an amount equal to 10 per cent of his salary. This bonus is increased 1 per cent for each additional 10,000 cu.yd. or fraction greater than a half. With the bonus system the monthly runs have gone up from 90,000 cu.yd. a month to over 100,000 cu.yd., and frequently the 1 per cent additional bonus has been earned.

The fill is being made for the new factory of the H. W. Johns-Manville Co., the contractors are the Construction Materials Co., Chicago, with J. R. Sensibar, president, in general charge of the work. Patents for some of the original methods and devices have been applied for.

Engineering Bodies Study Government Organization

A three-months' study of the administrative organization of the federal government has been undertaken by the budget committee of Engineering Council, the National Public Works Association, the National Educational Association and the American Public Health Association. Representatives of these organizations will remain in Washington until the work is complete. The purpose is to work out a reorganization plan.

Active work has been in progress looking to the creation of a Department of Education. Steps have been taken by others toward securing a Department of Public Health. Still others have been in favor of the combination of the two under a Department of Public Welfare. These measures are being considered in connection with the establishment of a Department of Public Works. The present study is being made with the idea that these various efforts may be amalgamated.

The organizaton making the present study is to be known as the National Committee on Governmental Economy. Stanley H. Howe is the director of the committee and C. T. Chenery is its executive secretary. Other members include Harold N. Graves, John T. Pratt, J. Parke Channing Francis Blossom.

Why Street Railways Should Bear Share of Pavement Cost

Brief of Data from 166 Cities Gives Reasons Why Two-Foot Strip Outside Rails Should Not Be Diminished

As an aid to American cities where efforts may be made to transfer at least a share of the burden of paving expenses from the traction corporations to the cities or abutting property owners, William P. Capes, director of the New York State Bureau of Municipal Information has prepared a summary of the arguments presented to the recent session of the New York Legislature against a proposed revision of the law which requires traction companies to construct and maintain the pavement between and for 2 ft. on either side of street railway tracks. The proposed revision of the law, fostered by the New York State Street Railway Association, would reduce the area of pavement construction and maintenance responsibility to a strip between and for 6 in. on either side of the tracks.

Amendment Opposed

Through the New York State Conference of Mayors and Other City Officials, 59 cities in the state opposed the proposed amendment. At the request of the chairman of the Senate Committee on Public Service, to which committee the bill had been referred, each city, through its mayor and city engineer, compiled a brief giving the reasons for its opposition. The committee also received a report from the New York State Bureau of Municipal Information summarizing the data it had received from 166 American cities of 30,000 or more population. The latter report showed that of these cities, sixty required the street railway company to pay for the construction, reconstruction and maintenance of pavements (original, repavement, temporary and permanent), between and for 2 ft. on either side of their tracks. In fifteen other cities the companies are responsible for the pavement between and 18 in. on either side of their tracks and in eleven others for 12 in. on either side of their tracks. The plans vary in the remaining cities, but in all, except one, the companies are held responsible for the pavement of at least that part of the street surface which is occupied by their tracks.

Following is a summary of the arguments presented, which apparently had their effect upon the Senate Committee on Public Service inasmuch as the proposed amendment was never reported out of committee:

Heavy urban cars, and not the ordinary travel, are responsible for constant repairs to the pavements.

Modern electric cars are from six to ten times the weight of the horsecar formerly used, such a weight producing correspondingly increased vibration and resulting in more rapid pavement disintegration. In addition, the railroad companies run cars over tracks while the pavement is under construction so that a complete bonding of the materials is seldom obtained.

Drainage Difficult

Drainage of pavements upon which there are rails is much more difficult than draining other pavements. The contour of the street must be altered to provide for drainage along and adjacent to the rails as the inability of any roadbed construction to withstand seepage of water into it by creeping along the rails is well known. The rail affords the first opportunity for the water to enter subgrade, and therefore it forms the first point of weakness in the pavement.

It is impossible to maintain any modern satisfactory pavement adjacent to any car track construction unless such track construction is made rigid. The incentive to make such rigid construction now rests with the traction company to lessen the cost of pavement maintenance. With such incentive removed, the company would naturally resort to a cheaper construction resulting in an increased cost of maintenance.

In case the company is to construct a track in a street already paved it becomes necessary to tear up at least 9 ft. of pavement in order to lay the track. This pavement has already been paid for once, and it may be relaid after the tracks have been placed in such a way that it is apparently on the surface as good as new, but there is a longitudinal crack in the base which eventually works toward the surface under the stress of constant vibration.

Tie Replacement Costly

Replacement of ties necessitates pavement cutting to a width of approximately 9 ft. This is a charge which in all fairness should be paid by the railway company. Rigid pavements frequently have to be disturbed before their useful life is spent in order for traction companies to renew bonds, replace broken rails, and retighten joints.

A pavement which has been torn up cannot be restored to as good condition as before; consequently the location of railway track in a street tends to destroy the life of the whole pavement.

General street railroad engineering has established the fact that repairs to paving in the railroad area consumes 17 to 20 per cent of the total cost of maintenance of way, so a reduction of seven-ninths of this obligation would not help the railroad company more than the additional cent charged in a six-cent fare.

The life of the roadbed of a railroad is about twelve years, and the life of a durably constructed pavement is over twenty years.

It is a well-known fact among engineers that no matter how well a pavement is constructed it will heave along the rail line and does not settle back in the spring as it should. Each year increases the degree of trouble. It is also well known that street railroad companies use quantities of salt around switches in the winter time, and this has a very serious effect upon the pavement.

Defective rails cannot be properly removed and replaced in a 1-ft. area, particularly on curves.

Heavier Construction Under Tracks

Cities should not be required to pay for the cost of greater excavation and heavier construction required under tracks, which are necessary purely for the support of a company's cars.

Street railway tracks necessitate special and more expensive pavement construction. The use of T-rails instead of flange rails necessitates the use of a special type of brick contiguous to rails more expensive than the regular paving brick. The fitting of these bricks to the rails also involves additional expense in laying the pavement.

Increased pavement width is usually necessary upon streets where there are railway tracks in order that a line of travel may be supplied on either side of the track.

In repairing or connecting subsurface structures it is frequently necessary to excavate under tracks while cars are in operation, a fact materially increasing the expense of such subsurface installation.

Pavements are damaged by the operation of snow plows and snow sweepers during the winter.

It is fallacious to believe that the conditions existing today relative to the destructive influence of trolley tracks and the operation of trolley cars over them are not the same as they always have been. The traction companies' false idea of economy, in general, has been a reduction of the first cost in ballasting their tracks. This, in conjunction with the rapidly increasing weight of cars, has extended the destructive circle of influence more than 2 ft. outside the outside rail.

If the traction companies are relieved of this obligation the increased cost of pavement and repair is thrown back on the property owners by assessment for local benefits derived, or, if a general improvement, new revenue has to be obtained by an increase of the general tax.

Unjust Taxation

If it is a question of financing the work surely the railroads and indirectly the people who use them and benefit therefrom should stand this cost and not the entire community. Not over 50 per cent of the population has occasion to use the railway, and it does not seem proper to ask those who derive no benefit therefrom to help pay for the construction and repair, which would be the case if the betterment were charged to the city. The statute which it is proposed to amend is fair to the railway company, in that the area of street pavement which it is now obliged to maintain is that area within which experience of many years has shown to be particularly affected by maintenance and operation of its lines.

Presence between tracks of trolley poles limits the surface area of streets available for traffic, making the traffic heavier on the usable portions of the street, thereby causing greater deterioration and increased maintenance cost.

In the case of the presence of channel or slot rails the pavement between tracks is cut up into smaller slabs and the further presence of so-called manhole boxes tends greatly to diminish the life of the pavement, thereby causing much greater maintenance.

Nine-Foot Width Equitable

Nine feet, a dimension controlled by the 8-ft. railroad tie, should be definitely marked off by construction joints, and 9 ft. built and maintained by the railroad company. This places entire responsibility for damages due to subsequent failure within the railway strip where it belongs.

If expense for pavement adjacent to rails and 2 ft. outside has heretofore been deemed a legitimate charge, a change is not considered justifiable now in the light of the use of heavy cars, higher speed and more frequent operation.

A railway company is constantly ripping up pavements to repair its street car tracks. It is absolutely impossible for a company, were it to maintain only a 6-in. width on each side of its rails, to repair its tracks properly without disturbing other parts of the pavement, thus adding expense to the city.

The cities, upon the face of the performance by the street surface railroad corporations of their paving obligations, have granted many franchises on terms more favorable to street surface railroad corporations than they would have had they not assumed that such corporations would be obliged to pave the area described in existing law. If the liability on the part of the traction company existed then there has been nothing that has taken place in the meantime to affect this liability except to increase it.

The original purpose of this law was to place the burden of expense of this portion of the pavement upon the street railway company which enjoys the privilege of the use of the streets to operate a business from which it derives a revenue. Nothing has transpired since the law was enacted which justifies a change which would place the burden of expense upon the taxpayers.

In addition to the foregoing arguments others were offered supported by examples in some cities where existing street railways had been the direct cause of pavement failure or deterioration.

Flow Coefficient in 36-Inch Siphon

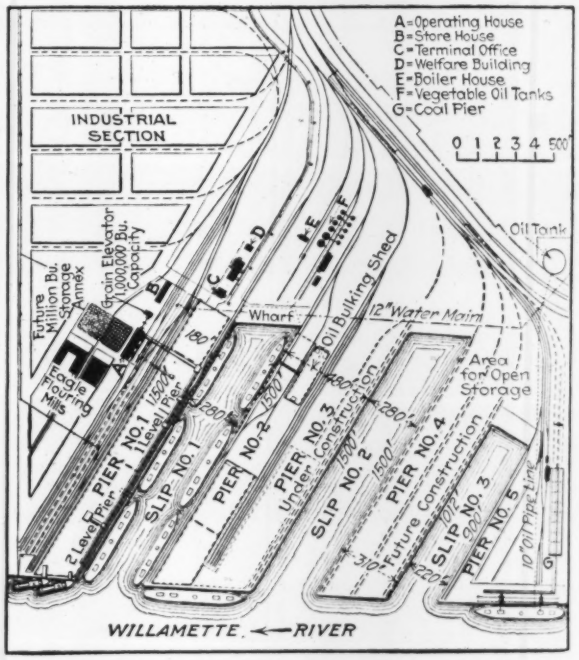
From observations made by the Board of Water Supply of the City of New York the coefficient of flow of the 36-in. flexible-jointed cast-iron pipe of the Narrows siphon was determined to be about 119.5 for the Chezy formula with a flow of about 14,000,000 gal. per day. At this time the pipe-line had been in service about three years. The figures are from the 1919 annual report of J. Waldo Smith, chief engineer.

Port Terminal Pier Design at Portland, Ore.

Considerations Which Led to Adoption of Wide Piers and Handling Machinery in the New Municipal Docks

By G. B. Hegardt
Engineer, Commission of Public Docks, Portland, Ore.

THERE has been no little discussion of late regarding the proper size and equipment of shipping piers in port terminals, particularly in relation to the Stapleton piers now under construction in New York City. As a contribution to that discussion the experience of the City of Portland, Ore., with its new municipal terminal development, may be of interest. The fundamentals of that development were described in *Engineering News-Record*, Jan. 22, 1920, p. 179. What follows is more an explanation of the design.



PRESENT LAYOUT OF TERMINAL NO. 4, BY THE CITY OF PORTLAND, ORE.

This terminal, designated as "Municipal Terminal No. 4," and the present layout of which is given in the accompanying drawing, is being constructed by the Commission of Public Docks by funds made available from a total bond authorization of $10,500,000 voted for the provision of modern terminal facilities for the port.

The universal custom in waterfront construction by private interests, and until the last few years by the city, was the quay type of docks or wharves. With the constantly increasing shipping and development of the port and the necessity of providing terminal facilities on a much larger scale than had previously been attempted or required, the commission, realizing the vital importance of having the facilities of the port brought up to the highest standard of efficiency, determined to construct a large import and export terminal, using pier and slip construction.

A site containing 159 acres, with a harbor frontage of 2,730 lin.ft., was acquired, as being conveniently located for easy access by the four transcontinental railroads serving the port and of sufficient area to permit of such future expansion requirements as would have to be provided for at a terminal of this magnitude, such as warehouses, cold-storage plants, vegetable-oil tanks, storage bunkers, etc., and extensive trackage facilities to adequately serve all terminal requirements and at the same time eliminate further congestion of existing and already crowded railroad terminals of the port. The acquisition of this large terminal area also contemplated an industrial section of about fifty acres.

While the first improvements contemplated at Terminal No. 4, when the site was selected late in 1917, consisted only in the construction of a 1,000,000-bushel grain elevator and Pier No. 1, with a trackage sufficient to care for these facilities, a complete terminal layout was made of the entire site, which is being closely followed as the construction is being carried to completion.

Principal Factors

The principal factors and problems given special study and consideration in the planning of this important terminal were:

1. Accessibility and ease of berthing vessels.
2. Most convenient and favorable connection with railroads serving the port, having in mind the necessity of eliminating further congestion of existing railroad terminals.
3. Quay or pier construction.
4. Type of structures.
5. Most satisfactory arrangement for an adequate trackage to permit of the expeditious switching of cars to and from the facilities and industries located on the terminal site.
6. Character of cargoes and commodities to be handled and stored.
7. Provision in construction for probable mechanical machinery that would be required in handling cargo.
8. Desirability of including an industrial section in the terminal site.

For the purpose of this article, however, only the matter of type of pier structures and railroad trackage will be covered, as the plan submitted herewith shows the general terminal layout and the facilities constructed, or now being constructed.

The question of width of pier shed that should be adopted as standard for this large terminal was given much study and consideration. In other terminals constructed by the commission the sheds were made only 100 ft. wide, following a practice more or less general at most ports of this country at that time. But as an operating proposition it was soon demonstrated that a narrow shed was a positive agency in producing congestion and that, in any new construction undertaken, a radical change should be made to insure greater efficiency and reduced cost in handling of cargo of the character which was most common to this port.

The construction finally decided upon was for transit sheds 180 ft. in width and, from results obtained during an operating period of over 18 months, this width of shed has fully met every practical and economical requirement in import and export cargo handling, as furnishing adequate floor space capacity for vessels of large size, discharging and taking out full cargoes, usually of many and varied commodities and sizes, permitting, in most cases, large vessels to discharge and take on full cargoes without changing their berth. It will be noted in the plan that these wide piers afford service to vessels from only one side, thus retaining the quay feature in operation, except in the case of Pier No. 4, the rear of the piers having depressed tracks for cars.

In the four main piers of this terminal a length of 1,500 ft. was adopted as furnishing the greatest flexibility and economy in operation, and being at all times ample for the accommodation of inbound and outbound cargo for two large vessels, and in most cases for three vessels of such size, and slips 280 ft. wide, sufficient space for two vessels, in addition to lighters or fuel barges. Besides, the tendency for vessels of larger dimensions in the Pacific trade is constantly growing and this condition must be provided for in all new construction; and the organization and equipment for the operation of one long pier must be relatively much less than for a series of short piers. The fifth pier is approximately 1,000 ft. long. The terminal, when fully completed, will afford, at one time, berthing space for seventeen vessels of a length of 500 ft.

Width of rear platforms of piers is 14 ft. and slip side platforms 34 ft., to permit there of the installation of crane equipment, when such machinery possessing great adaptability is called for and is available.

Probably one of the most important features of this terminal is its terminal and switching trackage. The great depth of the site made it possible to supply adequate trackage to all facilities of the terminal as the leads were amply long to bring them to the piers, grain elevator, oil storage, bunkers, etc., on easy curves, and it is believed that one of the prime requisites of a combined rail-and-water terminal, that of providing for the quick movement of cars, has been successfully solved at this terminal, which, when completed, will have a trackage, within the terminal site, of about 20 miles, exclusive of trackage serving industries.

Test of Automatic Train Control Device

Automatic application of brakes if the engineman on the locomotive should disregard signals is the basis of a train control system developed by C. F. Shadle, efficiency engineer of the Chicago, Indianapolis & Western R.R., and demonstrated recently on a six-mile stretch of mainline near Indianapolis, Ind. This part of the line is equipped with the automatic block system, the blocks being 4,000 ft. long, but with the automatic control system the roadside signals are supplemented by signal lights in the engine cab. On passing a "caution" signal there is a light application of the brakes, sufficient to reduce the speed to a predetermined limit, say 25 m.p.h. The engineman can make a heavier application if he desires to check or stop the train, but he cannot release the brakes until the limit speed has been reached. If a "stop" signal is passed, the brakes are set automatically to stop the train within a distance depending upon the speed. The brakes cannot be released until the train has come to a stop, the engineman then having to get down and operate a releasing device. Each automatic reduction of speed and stoppage of train is indicated on the chart of a speed recorder. Trials made under the supervision of the safety division of the Interstate Commerce Commission showed successful operation at speeds up to 65 m.p.h.

Footway Undercrossing for Busy Chicago Street

Special Details for Conduits in Shallow Roof—Large Sewer in Floor—Waterproofing and Expansion Joints

HEAVY pedestrian traffic to and from the Chicago suburban terminal of the Illinois Central R.R. at Randolph St., on the lake front, is intersected by the dense automobile traffic on Michigan Ave., so that even under the control of the police there is delay and confusion and some danger, especially during the rush hours when both the pedestrian and automobile traffic is at its highest. A spacious footway or under-crossing will relieve this condition, enabling pedestrians to cross Michigan Ave. in safety.

This under-crossing is being built by the railway company as the first step in a comprehensive joint program of railway improvement and city park development on the lake front (see *Engineering News-Record* of Aug. 21, 1919, p. 360). Eventually it will form the main approach to the station, but until the reconstruction of the Randolph St. terminal is undertaken the east end of the footway will terminate at lateral stairways opening on the sidewalk of Michigan Ave. Later it will be extended on a 4 per cent incline into the new station. The footway will be 16 x 8 ft. in section, with a present length of 137 ft. between stairways. Its general design is shown in Fig. 1.

Special considerations influencing the design of the structure included necessity for shallow depth and for watertightness, interference with a sewer, the requirement that pneumatic tubes and electric conduits be carried across the roof, and the urgent importance of rapid construction in order to cause as little obstruction as possible to the extremely heavy vehicle traffic. The last-mentioned consideration led to the adoption of encased I-beams for the entire length of roof, in place of a reinforced-concrete slab (on that portion where the available depth would have permitted its use), as such a slab would have to be left for some time to allow the concrete to set hard before replacing the pavement.

Interference with a 48-in. brick sewer made it necessary to keep the total height of the structure at a minimum. Even with all possible saving in height, however, the under-crossing could not be accommodated in the depth between sewer and street pavement, and therefore the roadway surface will be raised slightly above the present level, necessitating a modification in the street grades.

The soil at the site is mainly in old filled ground. As only half the width of the street can be blocked during construction the work will be done in two sections.

The design is intended to insure watertightness of

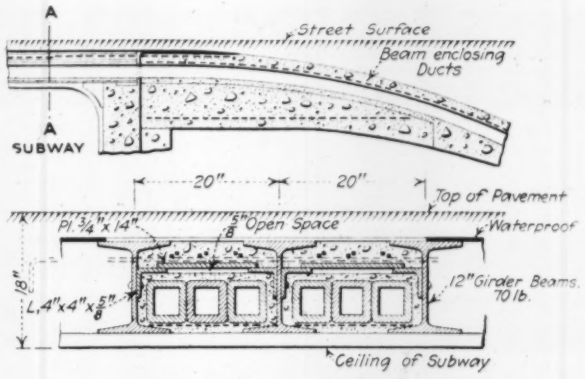


FIG. 2. ROOF OF FOOTWAY KEEPS ELECTRIC CONDUITS CLEAR OF PAVING

the structure so far as the exclusion of groundwater is concerned, but a drainage system will be installed for the removal of water used in cleaning and of surface water that may enter by the stairways. Inlets will connect to drain pipes leading to a gravel trap and then to an electric bilge pump beneath the floor, which will discharge the water into the sewer. A 7-in. bed of plain concrete will be laid on the bottom of the excavation, and the 6-in. vertical concrete walls for the protection of the waterproofing will be built upon it. A membrane of felt and pitch will be laid on the horizontal portion of this slab and the inside of the walls, the horizontal por-

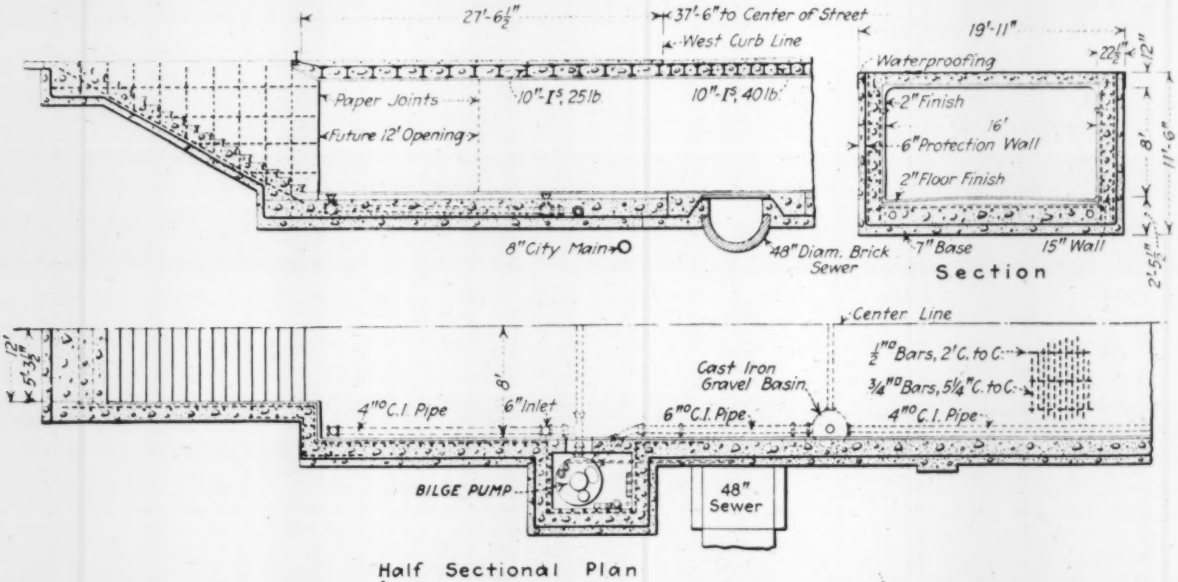


FIG. 1. FOOTWAY CROSSING UNDER MICHIGAN AVE., CHICAGO

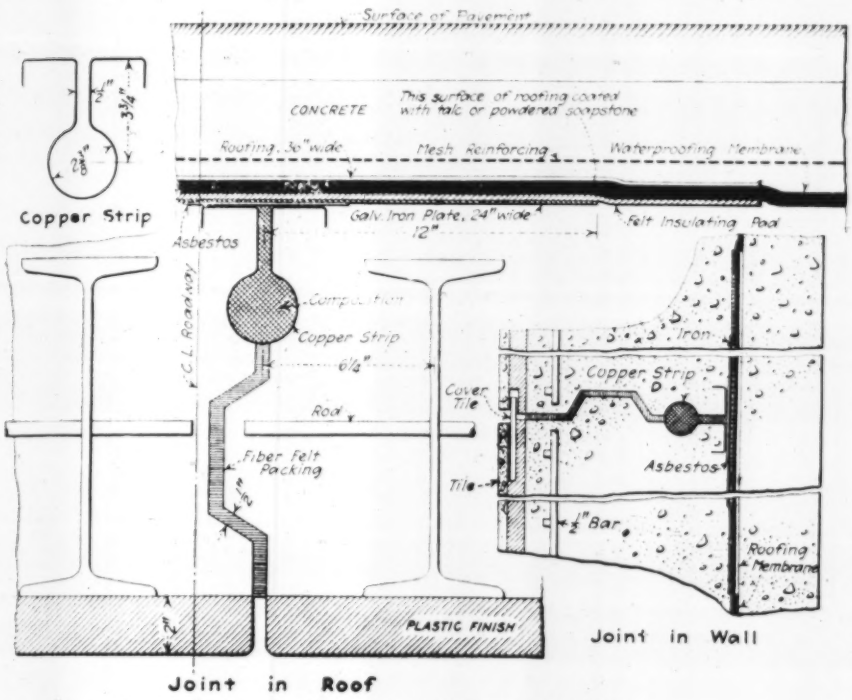


FIG. 3. EXPANSION JOINTS OF FOOTWAY

tion of this membrane being covered immediately with 1 in. of concrete to protect it from being punctured or injured while preparations are being made to pour the 15-in. base slab and side walls.

For the floor there will be a concrete slab 4 to 6 in. thick laid on the 15-in. slab and having a 2-in. wearing surface of non-slip wear-resisting composition, the surface being crowned 2 in. to assist drainage. For the roof there will be 10 and 12-in. I-beams spaced 12 to 24 in. c. to c. and cased in concrete. Between the top of the roof and the concrete base for the street pavement a waterproof membrane will be placed, being so joined to that on the side walls as to form a complete envelope.

Special roof construction with 12-in. girder beams is required to carry tile conduits for electric cables, as shown in Fig. 2. In the street these conduits are laid deep and placed in two layers. As they approach the subway they will rise on easy curves to the level of the roof, where they will be in a single layer, being supported on bars laid across the bottom flanges of the beams and being covered with concrete. Shelf angles on the webs of the beams will carry cover plates standing ¾ in. clear of this concrete filling and supporting the base of the pavement. The purpose of this open space is to keep the load-carrying part of the roof out of contact with the conduit construction, so that the latter will not be crushed or disturbed in case of deflection of the pavement under loads. Beyond the sides of the footway the conduits will be cased in reinforced-concrete beams until the depth of earth cover is sufficient to prevent breakage by the superimposed live load. Pipes and metal conduits at other parts of the roof will be embedded in the concrete filling between the I-beams.

Expansion Joints.—A single expansion joint will be provided in the roof and in each side wall. As shown in Fig. 3, the inner part of the ½-in. groove will be packed with fiber felt and the upper or outer part filled with a bulb-shaped copper strip containing an asphaltic composition. Upon the flanges of this strip will be a sheet of asbestos insulating fiber, a sheet of iron of No. 26 gage and finally a felt insulating pad upon which the waterproofing membrane will rest. The surface of the iron sheet next to the concrete is to be coated with paraffin to form a non-adhesive surface. The outer surface of the membrane for a distance of 18 in. on either side of the joint will be covered with a sheet of prepared roofing, coated on the inner side with talc or powdered soapstone. By this arrangement the waterproofing membrane will have a free width of 36 in. in which to stretch or contract.

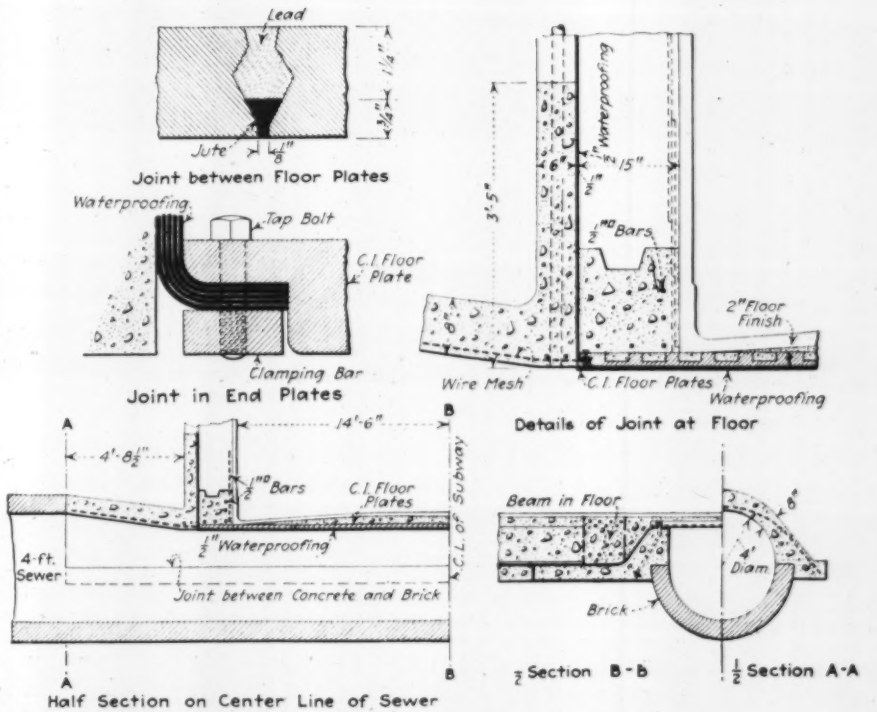


FIG. 4. TOP OF SEWER BUILT INTO FOOTWAY FLOOR

As the floor intersects a 48-in. brick sewer the sewer is converted into a trough section with a flat roof of cast-iron plates designed to be watertight under an upward pressure due to a head of 4 ft., as shown in Fig. 4. The upper part of each side of the trough will be of concrete, extended as a slab to relieve the load on the brick invert. In the floor of the subway will be formed two transverse reinforced concrete beams to carry the load and prevent deflection over the sewer. Anchor bolts will secure the cast-iron roof plates to the concrete walls of the trough. To prevent upward leakage the edges of the plates are shaped to form dovetail packing grooves, as shown in the detail, the lower part being packed with jute and the remainder of the joint then filled in with melted lead. At each side wall the vertical waterpoofing will be turned horizontally under the edge of the cast-iron plate and clamped by an iron bar drawn tight by tap bolts in the plate. Beyond the side walls of the subway a tapering roof of reinforced concrete will connect the special trough section with the normal circular section of the sewer.

White glazed tile will line the sides of the footway nearly to the top. The ceiling and the remaining portion of the side walls will be finished with 2 in. of plaster on metal lath, the top corners being curved to a 6-in. radius. Electric lamps will be placed in these curved corners. Concrete will be used for the stairs, the steps having 6-in. risers and 12-in. treads, with nonslip facing on the treads. Ornamental canopies or kiosks will cover the stairway entrances. This under-crossing was designed under the direction of D. J. Brumley, chief engineer of Chicago terminal improvements, Illinois Central R.R. The plans have been approved by the city authorities and the South Park Commission, and the contract has been let to the Nash-Dowdle Co., Chicago.

Illinois Health Board Assists Engineers

A circular letter to engineers issued by the Illinois Department of Public Health calls attention to the information and assistance that are available through the Division of Engineering and Sanitation. The activities of the division includes stream pollution, sanitary surveys and inspections, malaria control, city waste collection and street cleaning, investigation of typhoid fever and other water borne diseases, and control of water supply and sewerage systems. The division does not attempt to take the place of a consulting engineer, but encourages the employment of engineers by communities and it is believed that this has improved the attitude of the public officials toward engaging engineers in connection with proposed works. Dr. C. St. Clair Drake is director of the Department of Public Health; Harry F. Ferguson is chief sanitary engineer, at Springfield, Ill.

Erecting Cleveland Auditorium Roof with Traveling Falsework

By H. E. Gage
Engineer for United Erecting Co., Cleveland, Ohio

TRAVELING false work and derrick towers were used in erecting the 209-ft. steel roof trusses of Cleveland's new $5,000,000 municipal auditorium. The plant arrangement is not entirely unusual, but its application to this particular work is interesting in view of the large amount of falsework involved, the application of wooden trusses in the falsework, and the simple rolling arrangement of the plant. Because of the large size of the roof, the trusses weighing 200 tons each, special study was given to the planning of the erection method.

The building is 230 x 430 ft., and is located at East

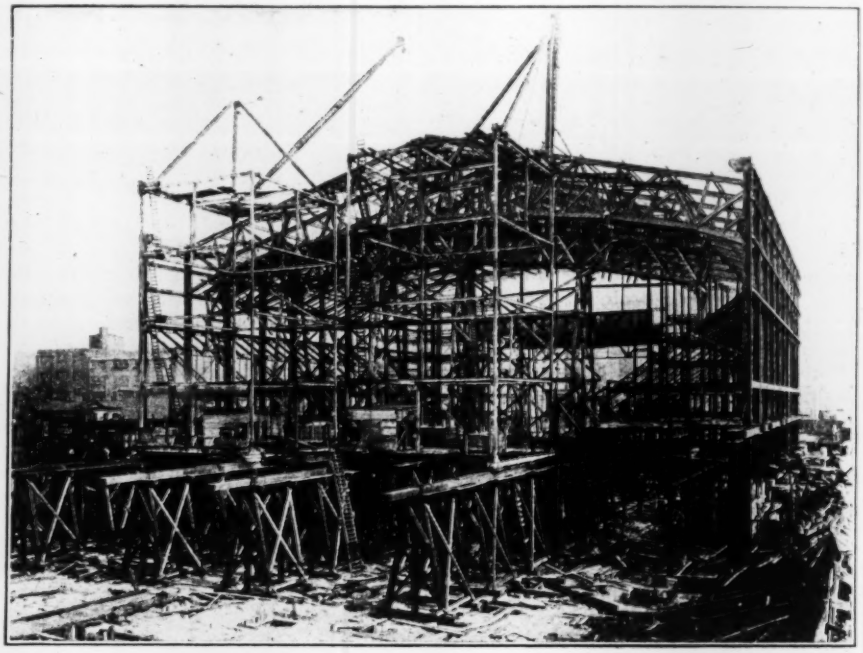


FIG. 1. AUDITORIUM ERECTION PLANT: DERRICK AND FALSEWORK TOWERS COUPLED FOR ROLLING TO POSITION FOR NEXT TRUSS

6th Street and St. Clair Ave. As the first step in preparing for steel erection, a gin pole was set up in the basement excavation, about 22 ft. below street level, and by its means a small wooden derrick equipped with 70-ft. boom was erected. This derrick placed four runs of low trestle bents on plank sills, to form longitudinal runways just above the first floor level of the building; sets of three 8 x 16 in. stringers on these bents formed the track for the derrick and falsework superstructure of the plant. A stiffleg derrick with bull-wheel, equipped with 100-ft. boom, was set up on the stringers, and this derrick erected two steel traveling derrick towers (Fig. 1) resting on rollers on the stringer tracks. Each of these towers was 40 ft. square by nearly 80 ft. high, and carried a single derrick at the outer corner facing the south or near end of the building. The derricks in turn erected each other on top of the towers.

Arched trusses spanning the full width of the build

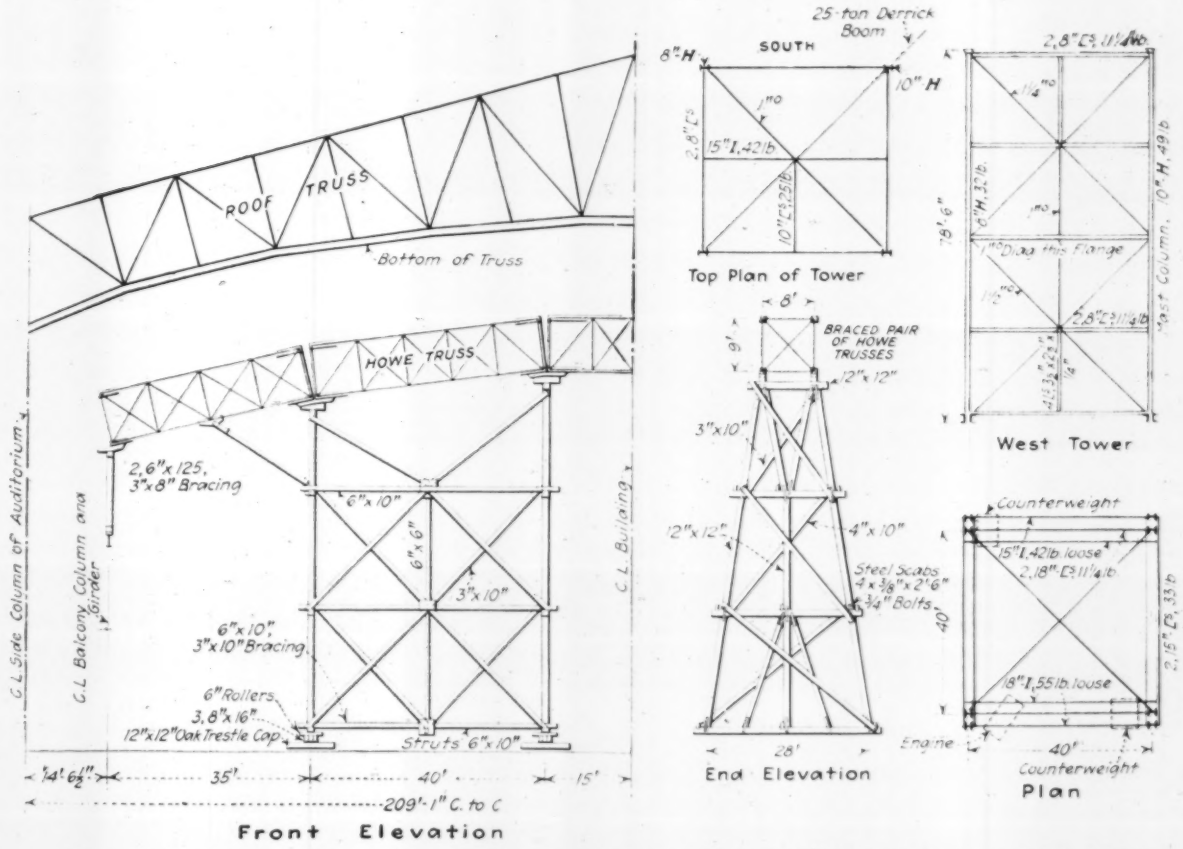


FIG. 2. TRAVELING FALSEWORK AND DERRICK TOWERS IN ERECTION OF CLEVELAND AUDITORIUM ROOF

ing and carried by attachments to the faces of the side columns formed the principal members of the roof that was to be erected. It was decided to erect them on timber towers set just in front of the derrick towers. The balcony framing, projecting about 50 ft. into the hall along each side of the building, could be used for supporting the outer end of the falsework trusses which formed the sills on which the steel was to be assembled. The resulting arrangement of the entire erection plant is shown quite clearly both in the photograph, Fig. 1, and in the sketch of the towers, Fig. 2.

Four large bents about 70 ft. high, set in planes longitudinal to the building, rested on rollers on the stringer tracks. They were braced in pairs to form two towers, one in front of each derrick tower. Together with two small bents carried on the balcony girders, as shown in Fig. 2, they supported a set of five wooden Howe truss spans of 35 to 40 ft. length, and 8 ft. wide by about 9 ft. deep. The tops of these trusses were about two feet below the roof steel, allowing for camber blocking and wedges.

Steel for the building was received by truck and unloaded from the street. The bottom chord of each truss came in seven sections. In placing these, the center section was laid first, its middle point being set accurately to the center line of the building by transit. Then the other sections were successively connected and wedged up to proper elevation, as determined by tape and level. When the complete chord had been bolted up and connected to the wall columns, all web members were set and finally the top chord (shipped in four sections) was set in place. The truss was then riveted complete and swung by cutting loose the blocking.

Moving the plant backward to the position of the next truss was done by rolling the towers, after shifting the small side bents along on the balcony framing, the outer set of Howe trusses being supported by knee-braces from the falsework tower as indicated in Fig. 2. The derrick and falsework towers were coupled together, and were pulled ahead as a unit by the derrick hoist, whose cable was secured at the far end of the stringers, making a turn below the towers and derricks.

In dismantling the erection plant it was necessary to put a jib on one derrick to take down the other derrick and tower. The last derrick was taken down by means of the boom of the other, slung to an end column of the building.

Houses and Housing

Housing development, according to L. K. Sherman, formerly president of the U. S. Housing Corporation at a recent meeting of the Western Society of Engineers, is properly the work of the engineer, although it is often assumed to be that of the architect. House design, said Mr. Sherman, is undoubtedly the province of the architect. But "housing" includes the selection and development of site, the general plan to fit topography, the street layout, transportation to the site, sewerage and drainage, paving, water supply and other public utilities. All work of this kind is distinctly that of the engineer.

Light Railway and Motor Trucks Both Used on Road Job

Pennsylvania Builds Fifteen-Mile Concrete Section From Each End With Own Forces and Own Equipment

DIRECT comparison between the two most used methods of handling materials on concrete highway construction—by motor truck and by industrial railway—is possible upon the job recently begun by the Pennsylvania Highway Department on the Susquehanna Trail along State Route 1, north of Harrisburg and extending from Clark's Ferry through the towns of Halifax and Millersburg. This 15-mi. section, which is one of the most important of those under construction

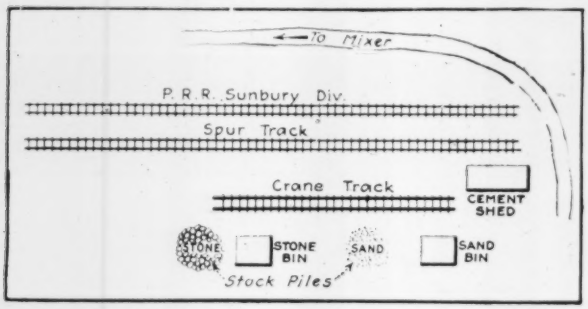


FIG. 1. LAYOUT OF MATERIALS PLANT WHERE MOTOR TRUCKS SUPPLY HAULAGE

in Pennsylvania, is being done exclusively by state forces, and all equipment on the job is owned by the state highway department.

The new highway, which is the Pennsylvania standard design—6-8-in. concrete, 18 ft. wide, of a 1 : 2 : 3 mix, and reinforced with 26 lb. of reinforcing mesh to the 100 sq.ft.—is being built from both ends. The two plant layouts are entirely dissimilar, each one being necessarily adapted to the type of haulage used. On the south end, where the state work connects with a contract job finished during 1919, batches are hauled to the subgrade by a fleet of seven 5-ton trucks, each truck carrying three three-bag batches. A layout of the southern materials plant, which is situated about a mile north of the southern end of the job on the Sunbury Division of the Pennsylvania R.R., is indicated by Fig. 1. Stone and sand are handled from open top cars spotted on a spur track to stock piles and stone and sand bins, of 40-cu.yd. capacity, by a locomotive crane equipped with a ¾-yd. clamshell. The features of this plant layout are the measuring boxes on both stone and sand bins. One of these measuring boxes, shown in Fig. 2, when filled, contains the exact amount of stone or sand for one batch. Trucks are backed up to stone and sand bins and these measuring boxes emptied into the truck batch compartments.

During the first day's run, hauling four instead of three batches on each truck was tried, but the heavy weight of truck and load was found too great for the subgrade, when wet. In the light of but a few days' experience the foreman on the job recomended the use of lighter truck units hauling three batches.

Though the new highway follows closely the old road alignment, there are places where considerable excavation is being done. The material, a stiff clay, is hand-shoveled direct into bottom dump wagons and hauled

FIG. 2. SAND AND STONE BINS FITTED WITH TWO MEASURING BOXES EACH

away by tractors to a point where it is either spoiled or used as fill. Except when the subgrade is extremely wet, it has been found that a Fordson tractor can handle two loaded dump wagons easily.

Fig. 4 is a layout of the materials plant at the northern end of the job. This plant, as well as the first one, is situated on the main line of the Pennsylvania R.R. Sand and gravel are handled from open top cars to a sand and stone bin 30 ft. wide and 150 ft. long, capable of holding fifty cars of stone and thirty-three cars of sand. A gantry crane, equipped with a ¾-yd. clamshell, one of several machines used on this job secured from the War Department, is used to transfer materials from cars to bins. The cement shed is approximately 18 x 80 ft. and has a capacity of fifteen carloads. In transporting materials to the mixer industrial cars are backed from the mixer under the sand and stone bins where they receive these materials through slide gates. Cars are then backed onto a wye and brought up in front of the cement shed. Materials are hauled to the mixer in ten-car trains, five cars being ahead and five behind the locomotive. In this manner if too great a grade is encountered, the five rear cars are cut off and

FIG. 3. TRACTOR REPLACES HORSES IN HAULING DUMP WAGONS

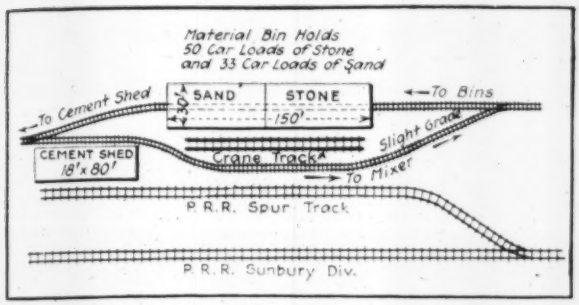


FIG. 4. LAYOUT OF MATERIALS PLANT WHERE INDUSTRIAL RAILWAY IS USED

the five front cars pushed to the mixer, the locomotive returning to pull the other five up. Each industrial car carries material for one mix—a five-bag batch.

On either end of the job expansion joints are placed at the point of curve and point of tangency of both horizontal and vertical curves and at the end of each day's run. Also, at each end of the job the mixer crew, including mixer engineer, men handling batch boxes, men laying forms, men at work on the subgrade and those finishing, is sixteen men. This figure does not include truck drivers in the one instance, and engineers and brakemen on industrial trains, in the other case.

As this is the largest of the jobs being done directly

FIG. 5. STONE ARCH BRIDGE RECONSTRUCTED WITH CEMENT GUN

by the state and with its own equipment, complete details are being kept so that when the season's run is finished, accurate comparison between the two methods of materials haulage may be had. Some comparison will also be had between contract work and day labor. As the job had but started early in August it was impossible to secure a comparison in the amount of pavement laid between the two methods used.

The Superintendent of Construction of the Pennsylvania State Highway Department reports to the Chief Engineer and is directly responsible for the job being done by the state forces. On the job he is represented by a foreman who reports to him and who corresponds to the contractor's superintendent. On each of the jobs the engineering department maintains inspectors.

The state is trying an experiment in the matter of housing its own employees. On the job it has erected a number of sectional houses, containing living quarters, mess hall, commissary, offices, etc. The commissary and mess hall are run at cost.

One of the interesting sidelights in the construction of this portion of State Route 1 is the repair of a twin-arch stone bridge, situated about half way between Clark's Ferry and the lower materials plant. The arches have a clear span of approximately 25 ft. The bridge, built in 1840 was designed as an aqueduct and used by the old Pennsylvania Canal Co. It is approximately 30 ft. wide and is now overlaid with several feet of dirt well compacted by many years of travel. The bridge is being strengthened by grouting with a 1 : 2½ cement-sand mix, applied under pressure, 80 cu.yd. of sand and 200 bbl. of cement being necessary. Fig. 5 shows the bridge under reconstruction.

Temperature of Steel Exposed to Sun

OBSERVATIONS made at Balboa Heights, C. Z., during April, 1920, to determine the maximum heating of steel or iron exposed to the sun's rays are reported by H. G. Cornwaite of the U. S. Weather Service, in *Monthly Weather Review* for July. Most of the tests were made on steel blocks 2 x 2 x 12 in., the temperature of which was indicated by a thermometer immersed in a mercury-filled ⅛-in. hole in the center of the block. The blocks were laid across a 1-in. board, 4 in. wide, lying flat on a concrete pavement, and were sheltered from wind by an 8-in. board on edge a few inches away on the windward side. The highest steel temperature was 133 deg. F., measured at 3:30 p.m. April 26. Mr. Cornthwaite considers that the exposure of the blocks represents approximately that found in the most protected sections of steel structures exposed to the sun, and he estimates that under the most favorable natural conditions possible in the Canal Zone the maximum temperature of exposed steel is not likely to exceed 140 deg. F. Comparing the climatic conditions with those of various parts of the United States, further, he estimates that the maximum exposed steel temperatures in the deserts of the Southwest may reach 169 deg. F. or higher. On account of the importance of such heating he suggests that measurements should be made at a few selected stations in different sections of the United States. That very noticeable effects are produced by the expansion due to one-sided heating has been observed in the case of the steel spillway gates of the Panama Canal, the leakage through which (a very small amount at any time) is greater in the daytime than at night, due to the action of the sun shining on one side and causing the gates to buckle or warp slightly.

Another set of measurements was made to compare the heating of blocks of steel painted with different colors. The curves representing the change of temperature of these several blocks throughout the day (April 20, 1920) are quite consistent and indicate that for the particular paints used the results may be depended upon as approximately correct. At the maximum, from 12 to about 2:30 p.m., with the air temperature in the shade about 88 deg. F., the temperatures of the white, red, green and black blocks respectively were 112, 114, 123, and 128 deg. F. About 2:30 the steel temperatures began to drop, though the air temperature was maintained for another half hour, when the sky was covered with thick clouds and there was a thunder storm in the distance. By 5 p.m., with air temperature 82, the four blocks of steel showed temperatures of 88, 90, 92, and 94 deg. F., in the same order as previously given. In some earlier tests by Mr. Cornthwaite, under slightly different exposure and with different paints, the maximum difference between white and black blocks was 20 deg. F.

Impressions Here and There

THE SACRAMENTO RIVER AND CALIFORNIA'S CAPITOL CITY

THE really big thing at Sacramento is "The Valley." One's expectation of finding something typical of the center of political activity of a great state is satisfied in the Capitol building, to be sure, but outside the zone of its immediate influence all the bustle and activity, all the visions of the future, center in one way or another on "The Valley."

One to whom this idea was expressed said, "What do you mean, Valley; San Joaquin or Sacramento?" He would not have asked that question had he known the city of Sacramento. Tho two valleys join, it is true, but the San Joaquin belongs to Stockton, to Merced, to Fresno and perhaps others, but the Sacramento Valley is the particular possession of the city of that name—a possession that is prized as highly or perhaps more than the honor of being the Capitol city. And the valley is prized because through its thousands of square miles of rich bottom land flows the Sacramento River.

Sacramento Flood Control—The river is at once the blessing and the curse of the valley. But there is prospect that the flood menace will be relieved by adequate control works. Up to the present time no less than five boards or commissions have been created by state legislative acts to carry out flood protection and drainage work. Some $2,700,000 has already been spent on the advice of such bodies and state and federal governments are committed to the expenditure of $6,000,000 more. Comparatively recently the state engineering department has added to its staff a flood control engineer with the necessary assistants and instead of the spasmodic attention, such as can be given by occasional boards and commissions, a continuous systematic study of river conditions and records is under way.

But the Sacramento River is no simple problem. Although it is the fourth river of the United States, in size, its flood volume as compared to its drainage area, is five times that of any other stream of this country. A commission of eminent engineers in 1904 recommended a flood protection scheme based on the flood of that year and three years later a flood of twice that volume occurred. Moreover, it is now believed that the flood of 1862 carried three times the volume of the 1904 flood.

Just as has long been the case with the Colorado River, state and federal legislators have refused appeals and petitions to provide flood protection on the Sacramento in the form of storage on the headwaters. Even now the best that is in prospect is the construction of bypasses whereby flood waters in excess of a safe amount are to be diverted into prescribed channels leading to Suisun Bay. This is rather discouraging after 40 years of engineering investigations and reports, particularly in view of the fact that engineers agree, in the main, as to the advisability of expenditure for headwater storage. It is to be hoped that the present signs of increasing influence of engineers as a class will take effect in such direction as this.

Salt Water Creeps Up the River—As the channel of the lower Sacramento has been straightened and deepened, the salt water of the bays below has found its way farther upstream. Last year, because of the salinity of water at the intake, the town of Pittsburg had to abandon its pumping works, allow its lawns to die, and bring the water absolutely necessary for domestic use from a point far upstream by means of barges. The sugar refinery at Crockett, which formerly took water for its plant from its own river frontage, now has to go 50 miles upstream for water sufficiently pure for its use.

As the amount of water taken from the river has been increased to serve increased irrigated areas the minimum river flow has dropped to about 2,000 sec.-ft. at the city of Sacramento. With this low flow the water level here is only about 1.5 ft. above mean tide level. A few years ago there was no tidal effect at Sacramento, which is 130 miles from the Golden Gate, but now the tidal range is about 2.7 ft. At Rio Vista the tidal effect has increased 10 in. within the past year and the point of current reversal is now only 6 miles below Sacramento. It will be remembered that Sacramento is just now, after a fight covering many years, committed to a plan for taking its water supply from the river within the city limits.

240-ft. Booms and Speedy Reclamation—A familiar sight as one travels through the valley is the A-frames of dredges projecting above what seem to be rather high levees. The height of the levees ranges up to 20 or 22 ft. above the protected areas. The dredges too are of large proportions. Many have booms over 200 ft. long, the latest addition to a fleet of about ten owned by the Olympian Dredging Company has a 240-ft. boom and a 6¼-cu.yd. bucket. These dredges have been a factor in the rapid reclamation of rich bottom lands. A striking example of their speedy work appears in two pictures within the same frame hanging in Major Norboe's office. One presents a water-line horizon with a huge dipper dredge being towed across the foreground by a stern-wheel steamer. The picture alongside shows a field of grain stretching away to the horizon with a group of prosperous looking barns and farmhouses in the distance, as attractive a farm scene as can be imagined. The inscription under these two pictures reads, "These two Views were taken from the same spot one year apart."

July, 1920. SACRAMENTO.

Rice Culture Effects Potable Waters

Rice farming along streams used as sources of potable water supply has caused some nuisance in California, said C. G. Gillespie at the recent American Public Health Association Convention, by reason of the condition of irrigation water returned to the stream after use on rice fields. The rice is grown under water which is retained in broad shallow pools from June to September under conditions very favorable for algae development. When these pools are drained the quantity of algae discharged is sufficient to seed the entire river system below. On areas where rice culture is just being started mineral salts are often leached from the soil in sufficient quantity to prevent algae growth in the water but this does not improve the situation because the minerals are often more objectionable than are the algae.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Credit for Authorship

Sir—In spite of the fact that the matter of giving credit for authorship has been quite thoroughly discussed in the technical press for some time past, the following example of failure to follow the custom established by many authors is cited with the idea that discussion of the specific case may be invited to secure the opinion of others as to what constitutes "good form." The writer realizes that he is laying himself open to the charge of airing a personal grievance in the choice of the example cited, but this case was selected only for the reason that it appeared to be the one most available. Reference is made to "Excavation" by Allen Boyer McDaniel, S. B., recently published by the McGraw-Hill Book Company.

For the purpose of this discussion, it is proposed that matter secured from other sources may be divided into three classes as to their treatment and as to method of giving credit to the original author. These, with the writer's comments and example from the above-mentioned book, are as follows:

1. Data of a secondary nature or which is of quite common knowledge but necessary to include in the publication in order that it may be complete. The writer feels that an author is justified in omitting specific reference to the original author or to the publication in which such matter may be found, and certainly the quite complete bibliography is sufficient to cover such omissions if they may be considered as such.

2. Original data, with detailed descriptions of cost of work, conditions, etc. Example is found in Paragraph 235 of the book referred to. This quotation covers nearly a full page, contains a description of rather a unique type of dredge and the detailed cost record of operating this dredge for a period of fifteen months. The matter was quoted from an article prepared by the writer and printed in *Engineering News*, April 30, 1914. Credit is given to the publication from which the quotation was made, but the writer has noted that many authors go farther and give credit specifically for such matter direct to the original author.

3. Description of original methods, with illustrations. Example is found in Paragraph 233. While the matter referred to in this example was not quoted verbatim, it is obvious that use was made of the article contributed by the writer and printed in the Dec. 16, 1916, issue of the *Engineering Record*. The cut used is identical excepting that it was reduced slightly to fit the new publication. In this instance, credit was given neither to the publication nor to the original author. While the "original idea" referred to was of rather a trivial nature, the writer has always felt a certain amount of pride in its development and feels that in such cases credit might properly be given to originators of new schemes which are made available for the use of other members of the engineering profession by means of published descriptions. As a matter of fact, the writer desires to take this opportunity of rendering tardy credit to Mr. Roger Holmes, of the La Fourche Dredging Co. for his assistance in working out some of the practical uses of the hydraulic dredge in the land reclamation work referred to in the above article published in the *Engineering Record*.

ARTHUR M. SHAW,
Consulting Engineer.

New Orleans.

Sir—The writer has read Arthur M. Shaw's letter with a great deal of interest and regrets that he is unable to reply to the criticism specifically as a copy of the book referred to, "Excavation, Machinery Methods and Costs," is not available.

The paragraphs referred to are in the second part of the book, which is largely composed of a compilation of data from a great variety of sources. Every effort was made by the writer throughout the book to give full credit to the source from which information was received, as the casual reader will observe from a review of the book. However, the latter part of the book was written during the summer and fall of 1918, while engaged in the stress of war work, and it is highly probable that the article referred to in the third paragraph of Mr. Shaw's letter, and even others, were not properly referenced as to source. On account of the necessity for economy of space, and as the articles were fully listed in the bibliographies at the end of each chapter, only the name and date of publication was given.

The writer heartily agrees with Mr. Shaw in the view that credit should be given the author where original work is quoted. The writer recalls having done this in several cases. Where original work is published in an official or authoritative form, as in the case of research work published in a government or institutional pamphlet, the character and authorship of the work are generally clearly evident, but often in magazine articles these matters are not clearly set forth.

In closing, the writer would urge that full credit for authorship should be given wherever possible. If the writer has been at fault in this matter in his work, he will greatly appreciate having any other cases brought to his attention in order that due credit may be given in future editions of the book.

ALLEN B. MCDANIEL,
Development Specialist, Construction War Plan Division, War Department.

Camp Grant, Ill.

Memoirs of Capt. Andrew Talcott

As a memorial to Capt. Andrew Talcott, Corps of Engineers, U. S. A., the famous pioneer topographer and railroad builder, his son, the late Thomas M. R. Talcott, himself an engineer, prepared shortly before his death an account of his father's connection with the zenith telescope method of determining latitude, which has been named after him. This has now been privately printed and deposited in several of the leading libraries as a matter of record. Capt. Talcott was apparently the earliest user of the zenith telescope for the precise determination of latitude, although a Dane named

Horrebow in the eighteenth century devised a somewhat similar method which has linked his name with Talcott's in the description of the modern method. The memoir, partly made up of a 1893 paper by the late Gen. W. L. Marshall, Corps of Engineers, U. S. A., defends Capt. Talcott's right to complete originality.

A New Book on Dredging

REVIEWED BY PIERCE J. MCAULIFFE,
Consulting Engineer, New York City

DREDGING ENGINEERING—By F. Lester Simon, B.S. in C.E., Assoc. M. Am. Soc. C.E. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co. Cloth; 6 x 9 in.; pp. 182; illustrated. $2.50.

Engineers and contractors interested in dredging and all who follow the business of dredging will find this volume of unusual value, particularly as it contains some information which, so far as the reviewer has seen, is in no other book. It is apparent, however, that the author did not intend that his book would serve as more than a general guide to dredge designers, for they will find but little to assist them in the design of hulls, engines, boilers, auxiliary machinery or supplementary dredging plant, but no designer can help but benefit from a perusal of its pages.

In the chapters on bucket dredges it would seem very desirable to include a discussion of the merits of simple vs. compound main engines, scotch vs. water tube boilers and positive vs. adjustable friction for hoisting and maneuvering engines. In the chapters devoted to hydraulic dredging the author omits the lateral feeding cutter type developed by Robinson of Montreal and overlooks the fact that the suction dredge without cutter has been used very successfully in making extensive fills.

In the reviewer's opinion it would have been wiser to have omitted Fig. 31, p. 72, or else to have gone into a more complete discussion of absolute velocities and the effects of the various impeller blade angles. Moreover, the statement "There are no discharge vanes in dredge pumps" is apt to be confusing as a large proportion of dredge operators speak of the impellor tips as vanes. The reviewer imagines that the author had reference to diffuser vanes, which are used only in certain types of water pumps.

In defining the total head on p. 73, reference to the location of the point at which the suction-gage pipe enters the dredge suction pipe should have been made, for it rarely happens that this point is at the same level as the center of the dredging pump; therefore, in adding the suction gage reading to the other two components, a correction for the location of this point must be made. Also on pp. 79 and 80, a suction head of 12 in. is selected for a velocity of 10 ft. per sec. and again for a velocity of 17 ft. per sec. If 10 ft. is correct for the first case, it is certain that the suction gage would show from 15 to 18 in. for the second velocity. Moreover, as the medium that is being pumped in these examples is a mixture weighing 68 to 70 lb. per cu.ft. and not water at 62½ lb. per cu.ft. the theoretical horsepower formula, p. 80, should be, with a 10 per cent mixture of sand,

$$\frac{9{,}800 \times 130}{3{,}960} \times \frac{68}{62.5} = 350.$$

From numerous experiments that the reviewer has made, he is inclined to agree with the efficiencies shown by the Morris Machine Works chart, Fig. 34, p. 82, rather than with the author's statement on p. 78, that dredge pump efficiencies are generally 50 per cent or less. In fact, the reviewer believes that with a discharge velocity of 10 ft. per sec. the combined efficiency of the pump and engine can be safely taken as 55 per cent considering the 1 h.p. of the engine as unity, and that with a discharge velocity of 17 ft. per sec. this combined efficiency may reach 60 per cent.

The reviewer's experience with boosters convinces him that such an installation is not the delicate instrument that author would have us beleive. The initial pump and the booster may even be combined into a compound pump on the dredge hull or the booster may be located at any place in the discharge line so long as the first pump can deliver the mixture to the suction of the booster under pressure. Reference to the Morris Machine Works catalog, Fig. 1122 and 152, will show instances of compound dredging pumps. To avoid high pressures in the pontoon line, however, the booster is usually placed on the shore or on a float at the point where the pontoon pipe line joins the shore line. Moreover, with a variable speed motor driving the booster, there is no need for the extreme caution in opening and closing the valve in the bypass as described by the author on p. 86.

Such a book seems scarcely complete without a reference to the interesting dredging done on the New Orleans Inner Harbor Navigation Canal where conditions were overcome by very clever engineering. A paper (reproduced in *Engineering News-Record*, July 22, 1920) describing this work was presented at the December, 1919, meeting of the American Society of Mechanical Engineers. Chapter IX, under the section covering "Dikes for Impounding Basins," could well have contained a description of the method of building dikes by bleeding sand or gravel from bottom gates in the discharge pipe. A number of articles have appeared in the engineering magazines on this subject, notably *Engineering News*, June 11 and July 27, 1916, and *Excavating Engineering*, May, 1914.

The author presents the advantages and disadvantages of the various type of dredges clearly and fairly. The reviewer has on many occasions been met with the question, "Where can I find a book on dredging?" and has had to answer that the best places to go for information, from the American engineers' point of view, were the manufacturers' catalogs, even though these are, quite naturally, devoted each to the products of one producer. This book, therefore, fills a long-felt want in this respect and a ready reception is predicted for it.

Directing Human Relations in Industry

PERSONNEL ADMINISTRATION: Its Principles and Practice—By Ordway Tead and Henry C. Metcalf, Ph.D., Members of the Bureau of Industrial Research, New York City. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co. Cloth; 6 x 9 in.; pp. 538. $3.

By personnel administration the authors mean "the direction and co-ordination of the human relations of any organization with a view of getting the maximum necessary production with a minimum of effort and friction, and with proper regard for the genuine well-being of the workers." It is the complement of production administration and "a major staff function." It includes not merely the employment of workers, but also the charge of their welfare and of all that makes for their efficiency. It is a new profession and one that demands special education and training.

After an Introduction, the authors take up The Personnel Department, Employment Methods, Health

and Safety, Education, Research, Rewards, Administrative Correlations, and Joint Relations. Each of these parts is divided into two or more chapters. Joint Relations has two chapters on Shop Committee Organization, one on Employee's Associations, two on Collective Bargaining and one each on Employer's Associations, National Industrial Councils and The Purpose of Industrial Government. Useful reference lists follow each chapter.

As may be inferred, the book is broad in scope. While recognizing that the object of industry is production it never fails to consider the worker as a human being, whose various desires and aspirations, and weaknesses as well, should be taken into account. Many of the vexed industrial-social questions of the day are discussed. The attitude throughout is judicial, but humane.

The book cannot fail to be helpful to any employer or director of employees who is willing to learn from its pages how to secure "maximum necessary production with a minimum of effort and friction, and with a proper regard for the genuine well-being of the workers."

Industrial Housing and Town Planning

INDUSTRIAL HOUSING: With Discussion of Accompanying Activities; Such as Town Planning, Street Systems, Development of Utility Services, and Related Engineering and Construction Features—By Morris Knowles, M. Am. Soc. C. E., etc. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co. Cloth; 6 x 9 in.; pp. 408; illustrated. $5.

Mr. Knowles' book promises to be of great usefulness to the rapidly growing number and variety of people who are concerned with providing not merely houses but homes for workers in industrial plants. His conception of industrial housing includes the whole range of modern town planning. In fact, so broad is the treatment that the book might well have been named Industrial Housing and Town Planning.

The author approached his task with a wide training in municipal and utility engineering and industrial town development gained before the war, and in addition with a vast amount of direct experience and observation in the field of industrial housing resulting from his government housing during the war. In addition, he has had the benefit of the collaboration of the various members of his large engineering staff who have specialized in the numerous branches of municipal engineering, sanitation and town planning and housing treated in the book. The result is a volume notable for both breadth and detail.

A concise historical review of industrial housing opens the book. This is followed by a chapter on Fundamental Preliminary Considerations. The next seven chapters deal with town planning and public utilities, site selection, developing a town plan, streets and pavements, water-works, sewers and drains, refuse collection and disposal, gas and electric services. The chapters on streets and utilities are short monographs on their respective subjects, but written always with industrial housing in view and with illustrations drawn from practice.

Having finished with the utilities, the author returns to the more specific subject of housing. A chapter on family houses is followed by one on other buildings, including quarters for single men and women, stores and apartments, special service buildings (such as laundries, bakeries and hospitals), and buildings to meet social needs. This chapter is followed by one on administration and supervision of construction (printed in condensed form in *Engineering News-Record*, Oct. 14, 1920 p. 748) which again is somewhat general in character. The final chapter deals with the various problems of managing industrial towns after they are built.

A considerable number of useful cost figures are given. Notable among these are some showing total and percentage outlays for houses and for accompanying land, streets and utilities. The illustrations include graphic plans and halftones, each kept down to a reasonable number of illustrations that really illustrate or supplement the text.

Altogether, the volume deserves high commendation. It is a pioneer in the presentation of the technical aspects of group housing, and in tying these to both the economies of industry and to town planning.

An Interesting Autobiography Continued

FURTHER INCIDENTS IN THE LIFE OF A MINING ENGINEER—By E. T. McCarthy, A.R.S.M., M.I.M. & M., M.I.M.E., M.Ame.I.M.E., F.R.G.S. New York: E. P. Dutton & Co., London: George Routledge and Sons, Ltd. Cloth; 6 x 9 in.; pp. 400. $7.

In noticing Mr. McCarthy's "Life of a Mining Engineer" in our issue of Dec. 11-18, 1919, we expressed the hope that the author would continue his keen and interesting observations of men and things in the out-of-the way places of the world. This he has done in the present volume, which contains his experiences as manager of various mines and later as consulting engineer. Like the earlier volume, this one is non-technical. It contains much about mines and mining but more about men and women, animal and vegetable life, rivers, lakes and mountains seen and enjoyed at and near mines and on long journeys to and from them.

The book begins with Yucatan, Tabasco and Chiapas and tells something about Mexico City. Next the reader is taken to Swaziland, South Africa. Among other countries visited and told of are Madagascar, Dutch West Borneo, Corea, Japan, China, Russia and Siberia and, at the last, Canada. The Boer War, the Boxer Rebellion and the Russian Revolution of 1917 all come into the story. Further evidence of the number and variety of sights and experiences recorded in the book may be presented in the form of entries in the index: Alphabet, Corean; baboons, large troop of; Dyak wedding; exorcising a devil in a Corean mine; fishing with cormorants; roof of Chinese house; travelling in Siberia; and Yi Yong Ik, a Corean Minister of State.

The story of exorcising a devil from a Corean mine is worth retelling in condensed form. Several accidents had occurred at this mine, some fatal. The mine workers were upset and declared that there was a devil in the mine. Mr. McCarthy took the declaration seriously and asked what could be done. The men replied that there was a witch some 30 or 40 miles distant who could get rid of the devil but that it would cost £6. Mr. McCarthy had her brought. The old crone, for such she was, first ordered a large bonfire built at the minehead, then descended into the mine and on down a small shaft in a bucket—for the devil would be found at the very lowest point in the mine. When this point was reached the witch declared that the devil was found and went through the motion of wrapping him in a piece of cloth. She then returned to the surface, ordered the bonfire made hotter and deposited the devil therein, carefully preserving the wrapping cloth. Thereafter accidents at

the mine ceased because—Mr. McCarthy reasons—the confidence of the miners was restored and with it their usual mental equilibrium.

These "further incidents" may be commended to engineers both because of their interest and in the hope that a wide reading of them will stimulate the production of similar interesting, instructive and inspiring books—inspiring because the author modestly relates many dangers overcome through strength of will, keen discernment, quick decision, rugged honesty, fair treatment and human kindness. Not every engineer has so rich a variety of incidents to draw upon but many have sufficient to produce a volume of fair size or at least an occasional paper.

Engineering Applied to Farm Colonies

HELPING MEN OWN FARMS: A Practical Discussion of Government Aid in Land Settlement—By Elwood Mead, Professor of Rural Institutions, University of California, Former Chairman, State Rivers and Water Supply Commission, Victoria, Australia. New York: The Macmillan Co. Cloth; 5 x 8 in.; pp. 228; illustrated. $2.25.

The application of engineering principles to land settlement and development, with state aid in financing farms and houses and in preparing the land for cultivation, are described in this book. The larger part of the volume details what has been done at the Durham colony of the California Land Settlement Board, of which the author of the book is chairman, but considerable space is given to state assistance in land settlement in Australia, and particularly in the State of Victoria, where the author was for some years chairman of the State Rivers and Water Supply Commission. In addition, there are chapters on National Carelessness in the Disposal of Public Lands, State Aid in Italy, Denmark, Holland, and the British Isles, Homes for Soldiers, and the Function of Government in Social and Industrial Development. An appendix gives the California Land Settlement Act under which the Durham settlement was established.

The underlying principle of state aid in acquiring and developing farms is to put the settler on his feet at the earliest possible moment. This means lending him money, if need be, for not only a part of the purchase price of the land, but also for a part of the cost of its improvement, including money for buildings, tools, etc., and livestock. In arid regions, it is recognized that leveling the land and providing otherwise for irrigation is a necessary part of the preliminary improvements. At the Durham colony, the Land Settlement Board took a hand in preparing the land for crops, providing a tractor and, more important still, also an engineering staff.

Many figures cited by the author show convincingly that the money necessary to acquire land is but a start toward establishing a going farm. Thus, at the first Durham settlement the average amount spent in improving thirty-five farms totaled $4,103, divided as follows: Buildings, $1,705; fences, $163; leveling and checking land, $619; stock, $894; equipment, $661. But this was not all that had to be spent before the first year's income was realized, for in addition there was paid out an average of $1,480 for seed, feed, labor, etc., $480 for living expenses and $311 for drugs, doctor's bills, trips for pleasure and the like, or $1,811 more, bringing the outlay in excess of the cost of land up to $5,914. This was for farms having an area averaging 52.08 acres at an average cost of $191.70 per acre and a cost per farm of $8,872. The first payments on account of land (5 per cent) averaged $444.

On this same first unit of the Durham settlement a number of farm laborer's allotments, averaging 1.72 acres each, were provided by the board.

It will be noted that the land comprising the first Durham settlement—the bare land without leveling, fences or buildings—cost an average of nearly $200 an acre. This high cost is due to the potential value of farm land when brought under irrigation in California. In contrast, the author points out that in the states along the Atlantic seaboard "thousands of acres could be bought for less than $25 an acre, in areas large enough to secure co-operative community organizations of from 100 to 200 families." These areas once "included some of the best farms in the country" and "under a carefully thought out program of crop rotation, the soil could undoubtedly be restored to its former condition."

The few details presented in the foregoing paragraphs will suffice, we trust, to show engineers that Dr. Mead's little volume is of country-wide importance.

Plumbers and Plumbing in Massachusetts

SPECIAL PLUMBING BOARD OF THE MASSACHUSETTS DEPARTMENT OF HEALTH: Report Submitted to the Commissioner of Public Health and Public Health Council, Jan. 3, 1920. Boston, Mass.: The Department. Paper; 6 x 9 in.; pp. 73; illustrated.

At the request of the Massachusetts State Association of Plumbers and under authorization by the State Legislature the Massachusetts Commissioner of Public Health appointed a board to consider the formulation of uniform state plumbing laws. The board consisted of six members, including Prof. George C. Whipple from the State Public Health Council and representative of various plumbers organizations. The report outlines the status of plumbers and plumbing in Massachusetts and in general. It concludes that a state sanitary code, to include plumbing, is desirable but does not submit a draft of a statute because there is first needed an adjustment of differences of view in the trade. Scientfic research in the field of plumbing is urged. The report is a valuable study.

Ohio Public Health Journal Resumes

After a lapse of four months the *Ohio Public Health Journal* has resumed publication with an April-August issue. To increase its circulation without added cost of publication the size is to be reduced and it is proposed to print only that which will have a direct influence for better public health in Ohio. The present 6 x 9-in. uncovered journal contains 32 pages, of which 5 pages are devoted to editorials and 9½ pages to a single historical article on "The Development of Public Health Administration in Ohio," the beginning of a series to furnish a background for a better understanding of the period of public health progress.

New Railroad Tie Bulletin

The National Association of Railroad Tie Producers, 900 Fife Bldg., San Francisco, has begun the publication of the *Cross Tie Bulletin*, having discontinued the *Railroad Tie Producer* with the issue of May 31, 1920. The new bulletin will be the official organ of the association in promoting the interests of tie production and in effecting co-operation with the users of railroad ties as well as disseminating in formation bearing on the cross-tie industry, according to the announcement of the association.

PUBLICATIONS RECEIVED

ADVERTISING THE TECHNICAL PRODUCT—By Clifford Alexander Sloan, Vice-President, Campbell-Ewald Co., Advertising Manager, Hyatt Roller Bearing Co., and James David Mooney, Vice-President's Staff, General Motors Corporation, etc. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co. Cloth: 6 x 9 in., pp. 365; illustrated. $5.

AMERICAN LUBRICANTS: From the Standpoint of the Consumer—By L. B. Lockhart, Consulting and Analytical Chemist. Second Edition Revised and Enlarged. Easton, Pa.: The Chemical Publishing Co. London: Williams & Norgate. Cloth; 6 x 9 in.; pp. 341; illustrated. $4.

The first edition of this book was favorably reviewed in these pages by Prof. John J. Flather, June 20, 1918, p. 1190. The Preface describes the book as an effort "to bridge the gap between the refiner or manufacturer and the consumer."

AMERICAN SOCIETY FOR TESTING MATERIALS STANDARDS: Adopted in 1920—Philadelphia, Pa.: The Society. Paper; 6 x 9 in.; pp. 128; illustrated.

Among the standards here included are specifications for building brick, clay sewer pipe, cement-concrete sewer pipe, materials for cement mortar grout filler and for cement mortar beds for pavements, yellow pine timber and also piles and poles to be creosoted and wood paving blocks for exposed pavements.

BITUMINOUS COAL STORAGE PRACTICE—By H. H. Stoek, E. W. Hippard, W. D. Langtry. Urbana, Ill.: Engineering Experiment Station, University of Illinois. Paper; 6 x 9 in.; pp. 157; illustrated. 90c.

Has section on actual experience with storage in 1918-19, effect of storage upon properties of coal and storage systems (including cableway conveyors, etc., and underwater storage).

BUSINESS RESEARCH AND STATISTICS—By J. George Frederick, President of the Business Bourse, Int., Inc., Author of "Modern Salesmanagement." New York & London: D. Appleton & Co. Cloth; 5 x 8 in.; pp. 342. $2.50.

THE DESIGN OF HIGHWAY BRIDGES OF STEEL, TIMBER AND CONCRETE—By Milo S. Ketchum, C.E., M. Am. Soc. C. E., Professor-in-Charge of Civil Engineering, University of Pennsylvania, etc. Second Edition, Rewritten. New York, McGraw-Hill Book Co., Inc. London: Hill Publishing Co. Flexible; 6 x 9 in.; pp. 550; illustrated. $6.

ELEMENTS OF ENGINEERING THERMODYNAMICS—By James A. Moyer, Director of the Massachusetts Department of University Extension, formerly Professor of Mechanical Engineering in the Pennsylvania State College; James P. Calderwood, Professor of Mechanical Engineering in the Kansas State Agricultural College and Andrey A. Potter, Dean of Engineering at Purdue University, formerly Dean of Engineering at the Kansas State Agricultural College. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 216; illustrated. $4.50.

An extension of "Engineering Thermodynamics," by the two first-named authors (see *Engineering News*, Feb. 17, 1916). Most of the new material was added by Mr. Potter. The Preface says the book "is particularly intended for use in technical colleges where it is possible to give special courses on the subjects of steam turbines, internal combustion engines, refrigeration and other applications of thermodynamics."

ENGINEERING AND BUILDING FOUNDATIONS: Including Sub-Aqueous Foundations—By Charles Evan Fowler, C. E., M. Am. Soc. C.E.; Member Engineering Institute of Canada, etc. Vol. I: Ordinary Foundations. Fourth Edition, Revised and Enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 531; illustrated. $5.

FUEL OIL IN INDUSTRY—By Stephen O. Andros, A.B., E.M., Member American Institute of Mining Engineers, Former Assistant Professor of Mining Research, Engineering Experiment Station, University of Illinois, etc. Chicago, Ill.: The Shaw Publishing Co. Cloth; 6 x 9 in.; pp. 274; illustrated. $3.75.

Deals with combustion and properties; comparisons with coal as fuel; distribution, transportation and storage; heating, straining, pumping and regulating boiler furnaces and burners; and numerous specific uses, such as in steam navigation, locomotives, iron and steel manufacture, ceramic industries, for heating buildings.

GRAIN DUST EXPLOSION AND FIRE PREVENTION CAMPAIGN: Proceedings of Conference of Men Engaged, and Conducted by United States Grain Corporation in Co-operation with Bureau of Chemistry, U. S. Department of Agriculture—New York: U. S. Grain Corporation, 42 Broadway. Paper; 6 x 9 in.; pp. 159; illustrated.

THE HOUSING BOOK: Containing Photographic Reproductions, with Floor Plans of Workingmen's Homes, etc. Compiled by William Phillips Comstock, Editor of Architecture and Building. New York: The William T. Comstock Co. Cloth; 8 x 11 in.; pp. 132; illustrated. $3.

Brief descriptions of 11 industrial housing schemes by their architects, together with a few pages on "Designs for Single and Double Houses of Moderate Cost" and on "Small Concrete Houses." Numerous floor plans and halftone views of single houses and groups of houses.

HYDRAULIC TABLES: The Elements of Gagings and the Friction of Water Flowing in Pipes, Aqueducts, Sewers, etc.—By Gardner S. Williams, M. Am. Soc. C. E., etc. and Allen Hazen, M. Am. Soc. C.E., Civil Engineer. Third Edition, Revised. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 115; illustrated. $2.

Changes in this edition, as stated in the Preface, are: A new chapter, entitled, "Additional Data," is a brief statement of how the old procedure for pipe flows fits with the numerous additional data now available. A plate has been added to show graphically the relations of the most important results both new and old. Minor additions and corrections have been made throughout the volume. The earlier editions were reviewed in *Engineering News*, Sept. 14, 1905 and Feb. 18, 1909.

IRRIGATION SURVEYS AND INSPECTIONS: Report, 1918-19—Ottawa, Can.: Department of the Interior. Paper; 7 x 10 in.; pp. 67; illustrated.

LABORATORY MANUAL OF TESTING MATERIALS—By William Kendrick Hatt, C.E., Ph.D., M. Am. Soc. C.E., Professor of Civil Engineering, and Director of Laboratory for Testing Materials, Purdue University, and H. H. Scofield, M.E., Assistant Professor of Civil Engineering in Charge of Testing Materials, College of Civil Engineering, Cornell University. Member: American Society for Testing Materials, Society of Automotive Engineers. Second Edition. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co. Cloth, 5 x 8 in.; pp. 177; illustrated.

To bring this book up to date particular attention has been paid to concrete. To make the book more generally useful, there has been elimination of "details of directions and apparatus more or less peculiar to any one laboratory." The first edition was noticed in *Engineering News*, Oct. 16, 1913.

THE LAW OF THE CITY PLAN—By Frank B. Williams of the New York Bar, Counsel for American City Consultants, Chairman City Planning Committee, City Club of N. Y. Supplement to the National Municipal Review, Oct. 1920. New York: National Municipal League. Paper; 7 x 10 in.; pp. 27. 25c.

A general review, with citations of legislation enacted by various states.

MARINE INSURANCE—By Solomon S. Huebner, Ph.D., Professor of Insurance and Commerce, University of Pennsylvania, etc. New York & London: D. Appleton & Co. Cloth; 6 x 9 in.; pp. 265. $3.

MILITARY MINING—By Alfred H. Brooks, Formerly Lieutenant Colonel of Engineers, U. S. Army, Chief Geologist of the American Expeditionary Forces. Washington, D. C.: The Engineer School, U. S. Army. Paper; 6 x 9 in.; pp. 43, illustrated.

NATIONAL CONFERENCE ON CONCRETE HOUSE CONSTRUCTION: Proceedings, February, 1920—Edited by the Secretary, Chicago, Ill.: Secretary's Office, 111 West Washington St. Paper; 6 x 9 in.; pp. 235; illustrated.

Last February at the time and place of the annual meeting of the American Concrete Institute there was called a National Conference on Concrete House Construction, to which were invited the many interests concerned in housing and construction. The meeting was highly successful in bringing out the development of the concrete house and in illuminating many of the financial problems of housing.

NEW YORK STATE WORKMEN'S COMPENSATION LAW: With Amendments, Additions and Annotations to Aug. 1, 1920. Prepared By The Bureau of Statistics and Information—Albany, N. Y.: The Bureau. Paper; 5 x 8 in.; pp. 114.

THE NEW WORLD—By Frank Comerford. New York and London: D. Appleton & Co. Cloth; 5 x 8 in.; pp. 364. $2.

One of the many books on world reconstruction problems. Devoted chiefly to Europe and particularly to Bolshevism in and out of Russia.

PUBLIC HEALTH AND MEDICAL EDUCATION IN MANY LANDS—By George E. Vincent, President of the Rockefeller Foundation. New York: The Foundation. Paper; 6 x 9 in.; pp. 44; illustrated.

RAINFALL INTERCEPTION—By Robert E. Horton, Consulting Engineer, Voorheesville, N. Y. Reprinted from Monthly Weather Review, Sept., 1919. Paper; 9 x 12 in.; pp. 20; illustrated.

A valuable study of "loss of precipitation which would otherwise be available to the soil." Based on the literature of the subject and extended experiments by the author at his private hydrological laboratory.

SEVENTH NATIONAL FOREIGN TRADE CONVENTION: Official Report, 1920—New York: National Foreign Trade Convention Headquarters, Indian House, Hanover Square. Cloth; 6 x 9 in.; pp. 863.

SOUND RANGING: The Location of Guns by Sound with Special Reference to the Bull-Tucker System. Prepared by Edward Beattie Stephenson, Ph.D. in Physics, Physicist, Office Chief of Engineers, U. S. Army, Formerly Captain of Engineers, U. S. Army. Washington, D. C.: Engineer School, U. S. Army. Paper; 6 x 9 in. pp. 25; illustrated.

SPILLWAYS FOR RESERVOIRS AND CANALS—By A. T. Mitchelson, Senior Irrigation Engineer. Washington, D. C.: U. S. Department of Agriculture. Paper; 6 x 9 in.; pp. 40; illustrated.

An admirable monograph, which does not attempt complete covering of the subject, but which is very informing, particularly in the treatment of the siphon spillway.

STANDARD SPECIFICATION FOR STEEL RAILWAY BRIDGES—Ottawa, Can.: Canadian Engineering Standards Association. Paper; 6 x 9 in.; pp. 79; illustrated.

THERMODYNAMICS FOR ENGINEERS—By J. A. Ewing, K.C.B., M. Inst. C.E., M. Inst. Mech. E., Principal and Vice-Chancellor of the University of Edinburgh, Formerly Professor of Mechanism and Applied Mechanics in the University of Cambridge. New York: The Macmillan Co. London: Cambridge University Press. Cloth; 6 x 9 in.; pp. 383; illustrated. $9.

The "fundamentals of thermodynamics," the author states in his Preface, are presented, first in non-mathematical form, as physical realities, with application to practical problems, then in their mathematical relations.

TOWN PLANNING SCHEME FOR JAMSHEDPUR—Report by F. C. Temple, Chief Town Engineer, Jamshedpur, Singhbhum District, India, to the Tata Iron & Steel Co., Ltd., Bombay. (Jamshedpur Social Welfare Series.) Boards, Cloth Back; pp. 17; 2 folding Maps.

Results of five-month's study by Mr. Temple, in consultation with S. K. Sawday, town planner, and T. W. Tutwiler, general manager of the company named above. Outlines scheme for an industrial town of 70,000, with particular reference to roads, water supply, sewerage, parks, race course and playground, churches and cemeteries for various classes of population and "burning ghats" for the disposal of part of the native dead.

LETTERS TO THE EDITOR

What Is Art?—A Defence of the Architect

Sir—It seems to the writer that your editorial "What Is Art," *Engineering News-Record*, Sept. 16, 1920, p. 531, and Messrs. Trautwine's and Hering's comments thereon do scant justice to architects.

To select some examples of exceedingly poor taste in design, and to judge artists and architects as a class thereby is hardly sportsmanlike. The several horrible examples of sham and gingerbread work cited, proved merely that although a man may sign himself architect and actually practice that profession, he is not really one unless properly trained for his work. No one would judge physicians as a class by the malpractice of some "quacks" who hold medical licenses.

Occasionally an engineer designs a bridge or other structure that has beautiful lines and proportions, as for example the Brooklyn Bridge, but more often we get the usual homely type of highway or railroad bridge so common everywhere. They are generally well designed and to quote Mr. Hering will give "The required resistance to every attacking force with the least amount of material, and in the simplest and most direct way." But they are hardly things of beauty except when judged by the rule of "handsome is as handsome does."

In France where engineers are second to none in design, an architect is always associated on important bridge work, and nowhere else in the world are these structures so beautiful as a rule. An architect of real standing was selected to assist in the design of all the large bridges built in recent years at New York. It would take a hardy engineer to say that the appearance of these structures was not greatly helped thereby.

It does the engineers no good to sneer at "art" or architects, because of isolated examples of bad design. The public is coming more and more to understand that rarely does the engineer put into his design the grace and beauty that the well trained architect can give. Hence the ever growing demand that architects, landscape gardeners, sculptors, etc., be consulted on great public works.

Up to about twenty years ago, engineers or "practical builders" designed nearly all the factories and industrial plants. For that time they were very good buildings, indeed, and served their purpose most satisfactorily, but nothing has ever equalled them as a class in sheer depressing and dreary ugliness. Today, architects almost always design these buildings, very often as subordinates to engineers. In spite of occasional examples of poor taste, these buildings are generally at least pleasing, and are often beautiful.

This difference from the old type of factory was not attained by the more common use of terra cotta, steel sash, etc. It lies in the general proportions of major and subordinate masses, the grouping of openings, the correct location of good ornamental design and a studied color scheme; all things of which the great majority of engineers have a very vague understanding.

The writer believes there is glory enough for all in large work, and that the engineer can no more enter the field of the architect than an architect can do engineering.

N. H. HOLMES,
Assistant Engineer, Charles T. Main.

Boston, Mass., Oct. 5.

Sir—I have read with interest Mr. Trautwine's criticism of the Bensalem Ave. bridge. There is no doubt that this structure has been marred by ornamentation wrongly applied, but when a man of his standing makes the absurd statement that because the engineer's training makes him an authority on strength it also makes him an authority upon beauty it is time to refute such a sweeping assertion.

The statement that any structure is beautiful which fulfills the purpose for which it is designed, is another half truth. Two men wear suits from the same piece of cloth. One suit has an ugly pattern and a discord of loud colors, but according to his logic, it is as beautiful as the other suit because it fulfills equally well the purpose for which it was made. Beauty is relative. A stone or concrete arch is infinitely more beautiful than any steel truss bridge can possibly be.

One of the first principles of architectural design is that ornament is not sought after for itself alone. Beauty of line and proportion always come first. Ornamentation is a minor detail. If your eye is drawn to the ornamentation first, the structure has not been successfully handled.

Mr. Trautwine forgets that there are any number of bridges in this country that have been successfully treated architecturally, such treatment in no way obscuring the essential structural features. He uses this bridge as a basis for an attack upon the principles of architectural design. One might retort in kind by reminding him that the engineer's "instinct for simplicity" must have been mislaid when the subway layout at the Grand Central Terminal was constructed. The fearful congestion of our cities is partly due to the so-called simplicity of the "checker board" system of laying out streets. The responsibility for the lack of a definite plan of our large cities rests largely upon the engineer because it was he who had charge of laying them out in the earlier days.

It is reasonable to state that while an architect of recognized standing would hardly be so rash as to claim to be an "authority" on beauty, he is by inclination and training better fitted to be a judge of beauty than Mr. Trautwine. There are just as many mistakes and errors of judgment in the design of engineering structures as there are examples of faulty architectural design. Mr. Trautwine should endeavor to correct the errors and omissions of his own profession before attempting to pass judgment upon another.

Pittsburgh, Pa., Oct. 2. S. S. MCKAY.

Influence of Price Decline

Sir—The editorial in *Engineering News-Record* of Sept. 30, 1920, p. 631, entitled "Influence of Price Decline," states that there is a possibility that in the immediate future the public will be found willing to get along with such housing accommodations as are available rather than pay any greatly increasing cost of providing new and additional housing. My observations in Chicago and other large cities have been such as to lead me to the opinion that the housing shortage is to a certain extent fictitious. It seems probable that the apparent demand for additional housing facilities is as badly inflated as was the apparent demand for numerous raw materials and fabricated materials early in the spring of this year.

It is apparently true that there have been five candidates for every four vacant flats and residences not alone in Chicago but in all other cities of great size throughout the country. It is equally true that owners of habitable properties of the better class have been able to secure most any price for the rental thereof. It is apparent, however, that the demand for high-class living accommodations has increased with greater rapidity than has the population of that class of people who hitherto used accommodations of this class.

So far as Chicago is concerned, before the period of war prosperity, we had approximately 125,000 workers employed in low-wage industries of a class corresponding to the garment workers. Families whose heads and members secured their living in these trades were compelled to live in tenement quarters in unfavorable sections of the city in two and three-room apartments renting from $5 to $10 per month. Single men in these industries frequently slept with four beds in a room and with two shifts of sleepers to each bed, one room renting for from $2 to $4 per week serving as accommodations for as high as eight men. Since war and post-war prosperity has been in effect the minimum wage in these trades has been approximately $40 per week. Each one of these many thousand families have thereby been removed from the tenement class and have been placed into active competition with the so-called white-collar class for housing facilities. Each of these men, formerly using from one-quarter to one-eighth of a single room are now

using and demanding a room apiece, and with each of these rooms fully provided with modern conveniences

As the present incipient shrinkage of industry progresses and increasingly large numbers of men and women are forced into the ranks of the unemployed wages will undoubtedly be cut. This great body of the submerged tenth which have for this short period come to the surface, will be forced to return to their previous environment. This will unquestionably be a bad thing for the individuals concerned, but will with equal certainty release the pressure for high-class homes and apartments. There are today standing idle in Chicago, and I presume in other large cities, thousands of these low-class habitations which formerly were teeming with life.

During the period of reduced building which has existed for the past five years, there have been practically no low-priced habitations erected. It seems very evident that when these thousands of temporary bidders for homes in good districts and with good accommodations are forced back to the tenement regions, many thousands of vacancies will occur in the very class of apartments and residences which are now the most hard to find. These facts should tend to render unlikely any unprecedented boom in the construction of buildings for residential purposes in the next year or two.

Does it not seem that producers and dealers in raw materials used in the construction industry would be wise to take these facts into consideration when making bold prognostication of long-continued excessive demand for all classes of materials? O. M. F.

Chicago, Oct. 11.

Jacoby Formula for Inclined Bearing Recommended for Coniferous Woods

Sir—The writer has noted the two articles, "Crushing Strength of Southern Pine at Angles to Grain" and "Inclined Bearing Tests on Douglas Fir and White Pine," and your editorial comment thereon published in your issue of Sept. 30, 1920 (pp. 629 and 653). Mr. Simpson carried out his tests as thesis work at the University of California, and since the writer acted as advisor to him in this work he has naturally read with great interest the articles by Professor Ayres, and has been surprised at the lack of agreement in the results found by the two investigators.

The subject of the safe bearing values for timber on surfaces inclined to the fibers has been discussed at various times in *Engineering News*, *Engineering Record* and *Engineering News-Record*. As has been noted in these articles, Jacoby's formula is a theoretical one, developed in his "Structural Details." It was pointed out several years ago, and has been proved by other writers, that the assumptions on which Jacoby's formula is developed are incorrect, and that theoretically the formula cannot be applied to a material of the nature of timber. Professor Jacoby in answering this criticism acknowledged the fault, but maintained that the formula would give values which were reasonable for design purposes. Since up to this time no tests have been available except those of Professor Howe's, the evidence of the actual tests not unnaturally has carried more weight than the advocacy of a formula theoretically incorrect.

In opposition to your editorial comment, "Since in each case the results are satisfactorily consistent among themselves, it can only be concluded that different kinds of wood are subject to different laws in this particular phase of bearing strength . . . On this account, safety would seem to dictate that in any practical application, the lower of the two existing formulas, the Howe formula, should be used . . .," the writer believes that the Jacoby formula will be found to hold for all coniferous woods, for joints such as are ordinarily used, i.e., similar in general to those shown in Fig. 1 of Mr. Simpson's article.

In the tests of Professor Ayres the pressure was intentionally exerted over the total surface of block, hence no shearing resistance of the timber could come into action. In Mr. Simpson's tests the bearing pressure was exerted over a portion only of the length of the block, although over the whole width, hence the shearing resistance did come into play. This difference may explain the variation in results found in the two sets of tests. In practically every actual joint the bearing pressure is exerted over a portion only of the timber, hence the writer's conclusion that Mr. Simpson's tests are more typical of actual conditions than those of Professor Ayres.

Professor Howe's formula and the test curves were based on a *constant indentation of 0.03 in.*, while the curves of Professor Ayres are based on the values at the elastic limit. Therefore, although the two curves as plotted in the article agree quite closely the agreement is only an apparent one, since the two curves do not represent the same thing and should not be plotted between the same limits. Mr. Simpson's conclusion that safe bearing pressures should be based on the elastic limit of the timber is well founded.

An indentation of 0.03 in. (not a unit deformation) means very little unless the length of stick is known, and is not a proper basis on which to determine values of unit compression.

The writer considers it unfortunate that Professor Ayres did not measure the deformations during the progress of the test and take the elastic limit from the plotted stress-deformation curves. The values for the elastic limit for crushing endwise (average 7,910 lb. per sq.in.) seem very high, even considering the low moisture content and the density of the wood (7 to 14 rings per inch).

To sum the situation, then, the writer is satisfied that the formula of Jacoby or the curve plotted therefrom will give the correct values to be used in the design of joints of Douglas fir and California white pine, and also believes that if tests similar to those of Mr. Simpson are made on Southern pine the same formula, modified as to constants, will be found to hold.

There is another subject in timber design, closely allied to the subject under discussion, which needs investigation by tests. This is the safe pressure to be allowed for circular metal pins bearing across and against the ends of the fibers of the timber. The writer would urge that this particular phase of bearing values for timber be investigated.

San Francisco, Cal., Oct. 7. H. D. DEWELL, Civil Engineer.

Shrinkage of Earthwork

Sir—Referring to the discussion that has taken place in the *Engineering News-Record* during the last four months regarding shrinkage of earth in embankments, I think your Mr. Tratman has given a pretty fair outline of the entire matter and that if anyone discusses this matter without taking into account the factors mentioned by Mr. Tratman he will not arrive at a correct solution.

It appears to me that Mr. Marshall and Mr. Oliphant of the Chicago, Burlington & Quincy R.R. are working on the right lines as indicated in the article published in the *Railway Age* of June 4, 1920. As far as my own experience goes I remember, as a boy on the farm, wondering what became of the earth I dug out of the post-hole after the post had been set, when the ground was properly tamped. I remember also some thirty-one or thirty-two years ago, when I attempted to get the chief engineer of a small railroad to insist that the contractors do less wasting in a rolling country, where the soil was a sandy loom, very similar to the soil I was accustomed to on the farm. His answer was: "You had better leave them alone. If they put all the material out of the cuts into the fills, you probably would have to pay them 10 or 15 per cent on account of the shrinkage of the material."

A few years later I had a similar experience in similar ground, where neither the cuts nor fills exceeded a depth of 4 ft. There was about a mile of work where the cutting slightly exceeded the embankment. The work was done with teams and drag scrapers. The material was not hauled over 500 or 600 ft., all done within the limits of the railroad. We were compelled to make borrow to complete the embankment. The apparent shrinkage or subsidence (which I think is quite a factor) amounted to between 10 and 12 per cent.

When a man makes a sweeping statement that "the earth does not shrink," as Mr. Charles Prelini did in a letter in the

Engineering News-Record of Sept. 2, 1920, page 475, without any qualifications of how, when or where the work was done or the measurements taken, it appears to me that the statement is decidedly open to question. I have run across earths that I am sure do not shrink very much and others that have either shrunk or subsided so as to require more material for the fill than was taken out of the cut. For all practical purposes this latter point is what we have to determine.

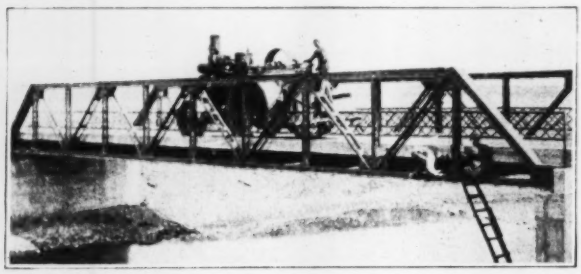
Winnipeg, Man., Canada, Sept. 22. J. G. SULLIVAN.

[A description of the shrinkage tests on the C., B. & Q. R.R. is given on p. 782. As to the last paragraph in Mr. Sullivan's letter, it may be said that we need more definite information as to the relative importance of factors that cause the generally accepted fact of shrinkage. There appears to be some question whether earth shrinks in itself, if placed, for example, on a solid rock bed. If the earth does not "shrink" but is placed on a bed which "subsides" there is still apparent "shrinkage" of embankment as compared with excavation. There may be both shrinkage of the earth mass and subsidence of its bed, so that determination of these independent factors is very desirable.—EDITOR.]

Need for Measurement of Highway Bridge Impact

Sir—I have read with interest the editorial in the Sept. 9 issue regarding the desirability of conducting investigations to determine the effect of impact on highway bridges.

In 1912 the Iowa Highway Commission, in co-operation with the Engineering Experiment Station of Iowa State College, conducted a series of tests to determine the effect of impact of rapidly moving vehicles upon highway bridges. These tests were made on concrete bridges and on steel bridges with wood and concrete floors. The impact instruments used were secured from the American Railway Engineering Association, where they had previously been used in determining impact stresses on railroad structures. With slight modifications these instruments were adapted for use in measuring impact stresses in highway structures.



IMPACT-STRESS MEASUREMENT ON 80-FT. STEEL HIGHWAY BRIDGE, IOWA TESTS OF 1912

Impact stress measurements were made on the structural members of both riveted and pin-connected steel bridges under several types of vehicle and engine loadings traveling at various rates of speed. The photograph shows one of these tests in progress on an 80-ft. riveted steel truss with concrete floor, using a 13-ton traction engine as load.

While this series of tests did not cover all types of highway bridges under all conditions of loading which might produce impact, yet it did indicate that the impact stresses under maximum load were such a small percentage of the total stress that they might with safety be neglected. The greatest impact was observed with light vehicles traveling at high speed, but under such conditions the bridge was not subjected to maximum load and the total stresses observed in the members were well within safe limits.

Since these tests were made there has been a great increase in the use of the heavily loaded motor truck traveling at high rates of speed and it is possible that under these conditions impact stresses might be found which would need to be considered in the design.

No doubt some co-operative arrangement between the Bureau of Public Roads and the state highway departments could be worked out which would provide highway bridge designers with all additional data required on this subject.

J. H. AMES,
Bridge Engineer, Iowa State Highway Commission.
Ames, Iowa, Sept. 23.

Sir—The proposal in your editorial of Sept. 9, "A Field for Experiment," that definite experiments be made to determine the actual impact effects of motor trucks on highway bridges, is one that should be heartily supported. Few tests in this field have been made, and those generally before the advent of the present heavily loaded and speedy vehicles. The results of these scanty tests show only that impact is much less for highway bridges than for railway bridges, a result that was anticipated, as the unbalanced driver loads of locomotives are not present. The recent impact tests on highway surfaces made by the Bureau of Public Roads show that impact on even moderately rough road surfaces may be large, and most certainly cannot be neglected in highway bridge design.

When impact has been considered at all in highway bridge specifications it has usually been taken at from one-third to one-half that for railroad bridges, but whether it is that much, or more or less, is not known, and this uncertainty should be finally cleared away by proper experiments. This is particularly true with regard to concrete bridges, for which we have practically no accurate knowledge as to impact, and these should certainly be included in any tests made. It is believed that the impact effect will be less, and probably considerably less, than for steel bridges, due to greater dead load; but, whatever it may be, due economy in design requires that it be ascertained.

Many experiments on all kinds of bridges and roadway floors and for all lengths of span will be necessary, and the actual stresses upon various members should be determined. The expense will be considerable, but is fully warranted by the resulting economy of design, and I am of the opinion that the matter should be taken in hand at an early date and pushed to completion as rapidly as possible.

H. E. WARRINGTON,
Assistant Highway Engineer, California Highway Commission.
Sacramento, Cal., Oct. 2.

Wind-Pressure Coefficient for Cylinders Varies with Dimensions

Tests to determine whether the wind-pressure coefficient for cylinders is constant regardless of the diameter of the cylinder were made recently at the Bureau of Standards, and are reported by H. L. Dryden in Scientific Paper No. 394, just issued. The purpose of the experiment was to test the theory of geometric similarity, used in correlating model tests of airplanes or parts with service results on full-size machines. According to theory, the coefficient of the square of the velocity should be found constant for geometrically similar bodies presented in the same manner to the wind, without regard to size. Tests on wood and brass cylinders ranging from 1 to 6 in. in diameter were made in a wind tunnel at velocities from 15 to 80 miles per hour, the higher velocities being restricted to the smaller cylinders. The cylinders were placed with axis normal to wind, and the arrangement was such as to make the results apply to cylinders of infinite length. It was found that the coefficient does not remain constant, but for a 1-in. cylinder is half again as large as for a 3-in. cylinder. Above a 3-in. diameter the coefficient proved to be practically constant, and equal to 0.426. The ratio of the average decrease in pressure on the back to the maximum increase in pressure on the front was greater for the small than for the large cylinders.

HINTS FOR THE CONTRACTOR

Portable Construction Camps

CONSTRUCTION camps on trailers hauled in train by motor trucks are successfully used by the Pacific Telephone & Telegraph Co., of California, in line construction operations. Each trailer train consists of five four-wheel trailers, which ranging in length from 12 to 24 ft. are fitted with bodies of railroad car type, 8 ft. wide. The steering wheels and drawbars are so connected that every trailer follows in the tracks of the towing truck.

The longest trailer is equipped as a dining car, having a U-shaped counter at one end, with stools for seating fourteen men, and a complete kitchen at the other end. This kitchen has all the appointments of a Pullman car cook room, including a large range, ice chest, dish closet, sink, hot and cold water faucets and bins for flour, sugar and vegetables. Another trailer is a combination office and sleeping car, with a central partition and end doors admitting to the office at one end and to the sleeping compartment at the other. The other two trailers, with center doors, are sleeping cars for the workmen and are fitted with a number of full-sized single berths, wash room, shower bath, etc.

All of the cars are mounted on standard 2-ton trailer chassis, the 25-ft. dining car and 20-ft. sleeping cars having reversible steering, while the 16-ft. office and sleeping car and the 12-ft. water tank and tool car have non-reversible single-end steering.

Handling Device for Concrete Pipe

IN BUILDING a 54-in. concrete pipe line near San Diego, Cal., the contractors, Bent Brothers, Los Angeles, used a device by means of which a team could be quickly hitched to a pipe section and the section rolled from the casting yard to its place on the line.

The device consisted of a steel frame with hardwood rollers engaging the inner surface of the pipe section.

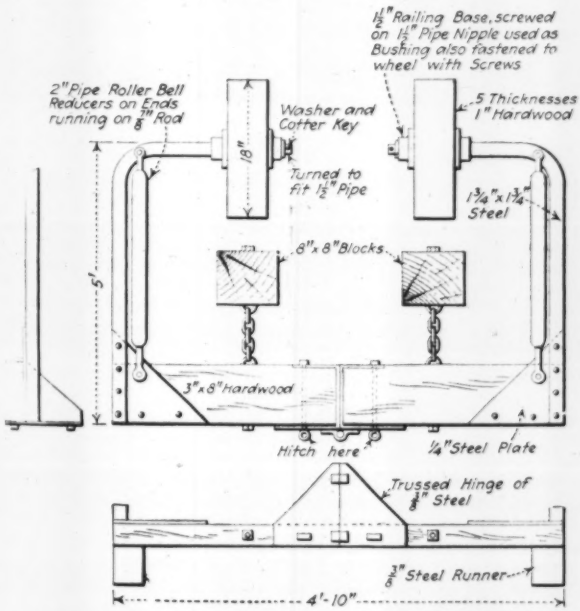

1½" Railing Base, screwed on 1½" Pipe Nipple used as Bushing also fastened to wheel with Screws
2" Pipe Roller Bell Reducers on Ends running on ⅝" Rod
Washer and Cotter Key
5 Thicknesses 1" Hardwood
18"
Turned to fit 1½" Pipe
1¾" x 1¾" Steel
8" x 8" Blocks
5'
3" x 8" Hardwood
Hitch here
¼" Steel Plate
Trussed Hinge of ⅜" Steel
⅜" Steel Runner
4'-10"

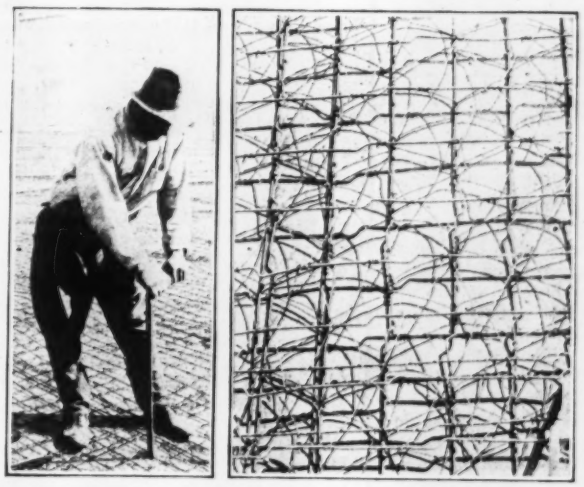
FIG. 1—DETAILS OF DEVICE USED IN TRANSPORTING CONCRETE PIPE

FIG. 2—TEAM EASILY HANDLES SECTION OF 54-IN. PIPE

Concrete weights were suspended from the frame to keep it from "riding up" to an undesirable height in the rolling pipe section.

Tool for Tightening Mesh Reinforcement

IN placing a 2-in. reinforced gunite concrete lining in the Herron Hill reservoir, Fitchburg, the contractor, A. V. Purnell, is using a simple and effective hand tool for tightening the wire mesh to make the sheets lie flat and taut instead of kinky, as they are when unrolled.



The tool consists of an iron bar with a right-angle bend at one end to give a handle by which the bar can be twisted, and a notch cut in the other end to engage a wire of the mesh. With this tool a workman can easily put a short reverse bend in a wire of the mesh. Putting a similar bend in each main wire of the sheet shortens the sheet and so tends to tighten it in the direction of its length.

NEWS OF THE WEEK

New York, October 21, 1920

Land Purchased for Approaches of New Orleans Bridge

(Special Correspondence)

An option on nearly 400 acres of land on the east bank of the Mississippi River above New Orleans has been secured by the Mississippi River Bridge Commission, this land to be used as site of the east approach of the bridge which the commission is charged with planning and constructing. Some time ago the commission bought 300 acres on the west bank. When purchase of the tract on the east side is completed the commission will control enough land for its purposes, and will have spent nearly $300,000. It is probable that the main part of the structure will be about 3,600 ft. long and its approaches on either bank about 2,500 ft. long.

Except for the land purchase, little progress has been made by the commission since its creation just four years ago by an act of the Louisiana legislature. The failure to make more rapid progress is not considered to be chargeable either to the commission or to its advisory board of engineers, but is due to political and business conditions. Despite the obstacles presented by the latter, the commission devoted about two and a half years to making a general study of the problem of crossing the river. A bridge was decided upon, on the ground that the depth of the river made it inadvisable to undertake a tunnel. An approximate location for the bridge was chosen, in the parish of Jefferson, about ten miles above New Orleans. While the navigation requirements as to span and height of bridge have not yet been fixed by the War Department, well-informed men believe that the commission will favor a low-level bridge. The probable cost of the structure at pre-war prices is said to be about $7,000,000, but at the present price level the cost would be more likely to reach $15,000,000.

The bridge commission consists of eleven members, selected from the Public Belt Railroad Commission of New Orleans, of which number five were elected by commercial bodies and exchanges of the city. The engineering advisory board consists of J. V. Davies, Bion J. Arnold and J. A. L. Waddell.

Camp Custer To Be Abandoned

The War Department announces that the Commanding General, Camp Custer, has been directed gradually to abandon and eventually to salvage Camp Custer, Mich.

Municipal Society Approves New Specifications For Concrete Paving, Sidewalks and Curb

Harmony Prevails at St. Louis Meeting—A. A. E. Schedule Approved —Brick and Stone Block Standards Not Changed

Net results of the four-day convention of the American Society for Municipal Improvements ending Oct. 15 in St. Louis, Mo., include approval of three specifications: (1) concrete streets; (2) sidewalks; and (3) curbs. These new standards now go to letter ballot together with two amendments to the constitution, raising the dues and rearranging the standing committee quota. The American Association of Engineers' salary schedule for engineers in municipal service was unanimously approved without debate. Incidental changes or additions were made in three existing standard specifications.

Total Registration 330

One-third of the active membership was present and the total registration reached 330. An extremely full program of papers and committee reports was provided and carried through with a good attendance, even at the last session on the fourth day. By judicious grouping the special subjects of sanitation, city planning and paving were presented at separate meetings, giving guests an oportunity to participate in numerous city inspection trips provided by the local committee in addition to the excellent arrangements for general inspections in which all participated.

Finances of the organization have made it necessary to curtail decidedly the former lavish printing of papers, proceedings and standard specifications. By selling the society's Liberty bonds and putting into effect a 50 per cent increase in dues the directors expect to come out about even for another year. The members number 611 and an active campaign is under way for a substantial increase.

Of the two amendments to the constitution the first will raise the dues of members from $5 to $7.50 and associates from $10 to $15.

Changes in Committees

The second amendment refers to a realignment of standing committees making four of them parent committees to which several sub-committees report. A street committee will have sub-committees on (1) paving, (2) sidewalks and street design, (3) street maintenance and (4) street railway construction. The city planning committee is divided into (1) local subdivision, (2) zoning, (3) utilities and (4) parking and open spaces. Traffic and transportation was with this list but was made a main committee at the insistence of Prof. A. H. Blanchard. Street cleaning is divided into (1) street cleaning, (2) refuse disposal and (3) snow removal; sewerage and sanitation into (1) sewerage, (2) sanitation, including sewage disposal and (3) public comfort stations. There was also added to the list of committees one on foundations and sub-grade and another on street railway pavements, including track construction. So-called double-barreled committees have been tried before without entire success but the amount of detail and number of conflicts has grown too great to be straightened out on the convention floor. This method of clearing seemed the only feasible one.

Specifications

Of the standards adopted and passed to letter ballot the tentative specifications for concrete pavements submitted last year have been redrafted. The principal changes refer to the two-course pavement, which is omitted, and to reinforcing, which the committee, of which E. R. Conant is chairman, feels should be required on certain streets but not be compulsory.

Tentative specifications of the society for concrete sidewalks have been adopted by the American Concrete Institute so they were sent to letter ballot without change, as were those on curb submitted for the first time by the same committee, of which S. Sammelman is chairman. The specifications for curb were made up after comparison with specifications from 50 towns and consultation with quarry operators as to practicable or economical sizes.

The sheet asphalt committee, R. K. Compton, chairman, recommended a number of incidental changes in the present standards and that a complete revision be undertaken with a view to condensation and simplification of matter and arrangement.

To the 1918 brick specifications approved clauses were added providing for a sand-cement cushion and asphalt filler. E. H. Christ is chairman.

A non-bleeding wood-block filler of special pitch has been used successfully in Minneapolis by E. R. Dutton, chairman of the committee on wood block. A specification for it to be added to

wood-block specification was passed for letter ballot. It is to be used only where a bituminous cushion is used.

Uniformity of specification for asphaltic cement used in bituminous macadam, bituminous concrete and asphalt block pavement is desirable according to the committee on these pavements, headed by Linn White. The society now has three separate specifications for asphaltic or bituminous concrete—bituminous concrete with one product of the crushing plant, Bitulithic and Topeka mix. The committee states that all these could now be combined in one since the principal patents on Bitulithic have expired. The society concurred in this opinion.

At the 1919 meeting, T. J. Wasser presented a revised specification for stone block pavements but the present committee, under H. H. Smith as chairman, felt that it was unwise to revamp the existing specification except to add a few incidental changes. With this the convention concurred, the changes to be printed and brought up for adoption in 1921.

Committees Report

The committee on sewers, W. W. Horner, chairman, felt that the society's existing specifications, adopted six years ago, are no longer satisfactory and that they should be rewritten. Agreement has been reached on form only. Part 1 on materials was submitted as tentative for study. Construction methods were not yet covered.

A special committee on foundations, of which R. K. Compton is chairman, submitted a tentative specification for old and new macadam base, an asphaltic base (asphaltic concrete type), and a tar bound base by the cold penetration method. The committee was made a standing committee and instructed to work with a similar committee of the Federal Highway Council.

To sponsor a uniform system of reports on parks and parkways giving physical and financial data in such a manner as to facilitiate comparisons and aid in securing efficiency was the recommendation of the committee on parks and parkways, headed by John M. Rice. The recommendation was concurred in.

Approval was given of standard tests for bituminous materials adopted by the American Society for Testing Materials for specific gravity, softening point of asphalt and tars, distillation, loss on heating oil and asphaltic compounds; by the American Society of Civil Engineers for flash-point, viscosity, float test, ductility and solubility of bitumen, and by the American Chemical Society for fixed carbons. The committee, A. H. Blanchard, chairman, feels that its duty is simply to review new methods as submitted and adopted by these other societies.

The recommendations of the committee on traffic and transportation, A. H. Blanchard, chairman, were approved. They call for design of intersections, where three or more streets intersect, so that rotary traffic may be installed; for careful consideration by engineers of the limits of car-stop zones so as not materially to reduce the roadway; for by-pass highways for transport service to avoid principal business streets, especially where local traffic is heavy; for a consideration by engineers of motor buses in extending transportation service. The recommendations are against excessively wide paved roadways in small municipalities.

The U. S. Government will become a member of the Permanent International Association of Road Congresses if a resolution calling on Congress to pass by December enabling legislation has effect. An invitation to hold the fourth International Road Congress in the United States, if received prior to Jan. 1, must be sent; otherwise the invitation of the Italian Government will be accepted.

In the city planning group of papers conditions in Pittsburgh, Washington and St. Louis were outlined and by illustration George B. Ford, of the Technical Advisory Corporation, New York, indicated suggestions from European practice in municipal improvements in the rebuilding of the devastated areas. Thomas Adams sent a paper on "Regional Surveys" and Harland Bartholomew described the zoning plan recently adopted for Washington, D. C.

The sanitary engineers, led by Langdon Pearse, T. Chalkley Hatton and Dr. Edward Bartow, participated in a spirited discussion on activated sludge, the only technical discussion of note during the convention. In answer to a question by N. T. Veatch, Jr., it was brought out clearly by Messrs. Hatton and Pearse that the activated sludge process can as yet only be considered for special cases and is not at all comparable with sprinkling filters as to cost. J. C. McVea, Houston, reported a cost of $14 per million gallons by the activated sludge method exclusive of overhead and treatment of sludge.

Paving Types Discussed

All of the different types of paving were represented by papers. John D. Hittell gave a valuable description of sheet asphalt paving on a country highway north of Chicago. Dr. Hermann Von Schrenck spoke on the condition of wood-block pavements in many cities recently visited and Philip P. Sharples indicated when it was worth while and when not to protect gravel roads by surface treatments.

An exhibit of materials and devices utilized by municipalities was well attended. At one end of the hall was an exhibit of city plans, photographs and models prepared by the City of St. Louis. Commendation is due the local committee for the clock-like precision and efficiency with which the excursions and other entertainments were mannaged. Baltimore secured the convention for 1921.

Tne new officers elected are as follows: President, Col. R. Keith Compton, Baltimore; vice-presidents, E. S. Rankin, W. W. Horner and E. R. Dutton; secretary, C. C. Brown, Valparaiso, Ind.; treasurer, Hermann H. Smith, Brooklyn, N. Y.

Great Lakes Engineering Works To Continue Operations

In contradiction of reports current for some time that it will discontinue business and sell its plants, the company, Great Lakes Engineering Works, Detroit, now announces that it will remain in the business of designing, building and repairing steel ships. The company has hull-building yards at Ecorse, just south of Detroit, and at Ashtabula, Ohio. In addition it has an engine building plant and fitting-out yard in Detroit. A. C. Pessano is chairman of the board, and J. A. Ubsdell is president and general manager of the company.

Hetch Hetchy Work To Be Financed Despite Injunction

Pending the outcome of the suit brought against the city of San Francisco to prevent carrying out the cost plus fee contract with the Construction Company of North America, all work on the 18-mile Hetch Hetchy tunnel would have to be delayed unless cash to meet immediate financial obligations were available. Accordingly the supervisors on Oct. 4 voted to buy Hetch Hetchy 4½ per cent bonds with $250,000 taken from the depreciation fund of the Municipal Railway.

Channel Tunnel Project Abandoned

Prospects for the realization of the project for a tunnel under the English Channel to connect England and France have practically disappeared, according to recent reports from English engineering circles. It is thought that military and political reasons played a part in determining an apathetic attitude toward the project, but its great cost and the uncertainty of earnings sufficient to justify the cost were also of influence. Moreover, because of conditions resulting from the war the national energies of England will be devoted largely to maintenance and reconstruction for some years, it is stated, and few new works of magnitude will be undertaken.

A. A. E. Members Enroll in Educational Classes

About 60 members of the Twin City Chapter of American Association of Engineers have signified their intention of joining one or more of the educational classes to be held by that chapter this season. The chapter is offering thirty-one courses in engineering and general subjects.

The association has opened offices in Boston at 50 Broomfield St. Fred C. Lewis is temporary managing secretary.

Military Engineers Will Meet in New York

The first regular meeting of the New York Post, Society of American Military Engineers, will be held at the Engineering Societies Building at 7:30 p.m., Oct. 26. The general subject for discussion, the army reorganization bill and its bearing on the engineer in civil life, will be treated under the following four topics: (1) History and general features of the bill; (2) War Department's general plan under the bill; (3) plans of the technical services; and (4) co-operation of the engineering profession and its national societies.

Other regular meetings are planned as follows:

Dec., 1920—Relations between command, the General Staff, and the services.

Jan., 1921—Annual dinner.

Feb., 1921—Functional organization of engineers.

April, 1921—Military and engineering defense of New York City.

May, 1921—Trip to West Point, N. Y.

It is desired by Colonel R. D. Black, chairman of the program committee, that the first meeting be attended by all who are interested in the national defense and in fostering effective co-operation between the engineering profession and the army, whether members of the society or not. The subject under discussion is the foundation on which will be built the future relationship between engineers and the service, a subject to which one year's work will be devoted.

New York Port Developments Include 1,000-Ft. Piers

Formal announcement has been made by the Cunard Steamship Co., Ltd., of the proposed construction of a new shipping pier development at Weehawken, N. J., on the Hudson River about opposite 36th St., New York City. The group will comprise eight piers of 1,000 ft. length and one shorter pier. Pier and slip widths and exact details of handling equipment or of layout have not yet been completed but it is understood that the scheme contemplates pier widths of 150 ft. with full width sheds and a multi-story marginal warehouse. Railroad trucks in the preliminary design do not enter the pier but approach the shed entrance from which freight may be transferred by tractor trailers. It is intended that the new group be used only for freight ships the passenger terminals remaining in the Chelsea district of New York City.

At the same time the Department Docks and Ferries of New York announced that it contemplates the construction of three piers each 700 to 1,000 ft. long and 250 ft. wide at Owls Head Bay, on the Brooklyn shore of the inner harbor just inside the narrows. Details of the scheme are not complete enough for further description at this time.

To Discuss Failure of Metals

A joint meeting on failure of metals is to be held in England under the auspices of the Faraday Society, the Institution of Mechanical Engineers and the Institute of Metals. The date of the meeting has not yet been fixed, but it is likely to be early in 1921. Failure under long-continued application of stress and under internal strain such as results from cold working or heat treatment will be dealt with, so that season-cracking and fire-cracking of brass as well as similar failures in steel are to be included. F. S. Spiers, 10 Essex St., London, is secretary of the joint committee in charge of the meeting. According to a preliminary announcement of the meeting in *Engineering*, new matter on the subject to be considered "will be placed at the disposal of the co-operating societies later in the year, and it is thought that this will afford an opportunity for a more comprehensive consideration of the subject than has yet been given to it."

Belle Isle Bridge Contract Is Readvertised

An amended form of contract has been approved by the Detroit City Council and as a result the Department of Public Works has readvertised for bids for the construction of the Belle Isle bridge. According to the contract approved the Commissioner of Public Works can order payment of 80 per cent of the amount of material to be used in the construction of the bridge as soon as the contractor delivers the material on the job. Ninety per cent of the bid price will be paid the contractor upon completed work. After completion of one section of the work the contractor will be entitled to 90 per cent of the contract price of the work done regardless of the remaining parts to be finished.

As a result of amending the form of contract, the date set for opening bids has been changed from Oct. 22 to Oct. 30. This action was taken by the city council upon the recommendation of Commissioner of Public Works Joseph A. Martin, to permit contractors to figure on the difference the amendment will make in their bids. The commissioner pointed out that as a result of the amendment, contractors bidding will not have to figure interest which it would otherwise be necessary to pay on borrowed money providing they were not advanced the 80 per cent on materials.

It is believed that as a result of the amended contract bidding on the bridge contract will be stimulated. The contractor to whom the work is awarded would have to count on between two and three million dollars being tied up for several months under the original type of contract before the amendment was made. This, it is believed, would have resulted in causing many contractors to refrain from bidding.

Active Standardization Work Now Under Way

Preparation of Many Safety Codes Is Progressing—Aircraft and Elevator Studies Being Made

Work on a dozen or two safety codes is now in progress under the general direction of the American Engineering Standards Committee, according to information just made public. In addition, steps have been taken to appoint American representatives of aircraft work to attend the next meeting of the International Aircraft Standards Commission. Work has been initiated in the direction of standardizing elevators.

On the subject of aircraft standards, a conference of five government departments, several societies, and the National Advisory Committee for Aeronautics was held a few weeks ago in Washington to consider an invitation to participate in the next meeting of the International Commission. Subsequently the favorable view of the committee was laid before the president and the latter thereupon requested the National Advisory Committee for Aeronautics to arrange for the presence of American representatives at the conference.

A request for considering the standardization of elevators was received by the Standards Committee from the American Institute of Architects and the Elevator Manufacturers Association of the United States. At a meeting to consider this request, held on Sept. 21, thirteen organizations were represented, and after full discussion of platform sizes, speeds, elevations, capacities, test methods, clearances, and the like, as well as safety provisions, it was resolved "that this conference fully recognizes the need and the desirability of standardizing such features of both passenger and material handling elevators as capacities, platform sizes and methods of test." A committee was appointed to confer with the Elevator Safety Code Committee of the American Society of Mechanical Engineers in order that further steps in elevator standardization might be properly correlated to the safety provisions already under study. It is expected that a report will be made to the American Engineering Standards Committee soon.

Safety code work now in progress under the American Engineering Standards Committee includes separate work on codes dealing with the following subjects: Construction work, electrical fire hazards, electrical safety, railing and toe boards at floor openings, lightning protection, machine tools, mechanical transmission of power, industrial sanitation, stairways and fire escapes, textiles, abrasive wheels, foundries, gas safety, head and eye protection, paper and pulp mills, power presses, non-fired pressure vessels, mechanical refrigeration, and woodworking machinery. The head-and-eye-protection code, which was formulated under the direc-

tion of the Bureau of Standards, has been completed and has been submitted to the American Engineering Standards Committee for approval.

The United States Department of Agriculture recently became a member of the committee. Three representatives have been appointed by the Secretary of Agriculture, one each from the Bureau of Chemistry (D. J. Price), the Bureau of Public Roads (A. T. Goldbeck), and the Forest Service (E. H. Clapp).

Fourteen Organizations Join Engineering Federation

Fourteen engineering organizations are now members of the Federated American Engineering Societies according to a recent announcement of the Joint Conference Committee, representing the four national societies of civil, electrical, mechanical and mining engineers. The latest entrants into the federation are the Kansas Engineering Society and the Alabama Technical Council. The complete list of charter member organizations up to Oct. 19 follows.

American Society of Mechanical Engineers.
American Institute of Electrical Engineers.
American Institute of Mining and Metallurgical Engineers.
American Institute of Chemical Engineers.
American Society of Agricultural Engineers.
Alabama Technical Council.
Technical Club of Dallas.
Detroit Engineering Society.
Engineering Association of Nashville.
Engineering Society of Buffalo.
Florida Engineering Society.
Kansas Engineering Society.
Cleveland Engineering Society.
Society of Industrial Engineers (Baltimore).

A.R.E.A. Directors Meeting Held in Montreal

The Board of Direction of the American Railway Engineering Association held a meeting in Montreal, Oct. 11, presided over by President H. R. Safford of the association, who is assistant to the president, Chicago, Burlington & Quincy R.R. The representatives of the A.R.E.A. were entertained by the Engineering Institute of Canada at a dinner at the University Club, and on the following day the party made a visit of inspection to the Quebec bridge.

Street Cleaning Officials Organize at Chicago

The International Association of Street Cleaning Officials was organized at Chicago Oct. 7 and 8, as a result of a conference called by W. J. Galligan, assistant superintendent of streets of that city. Mr. Galligan was elected president of the association. Other leading officers chosen were: Vice-president, Theodore Eichhorn, superintendent of streets, Erie, Pa.; secretary A. M. Anderson, 1340 Old Colony Building, Chicago; treasurer Robert W. Waddell, city engineer, Kansas City, Mo. The conference was attended by 44 street cleaning officials from 28 cities of the United States and Canada.

Training in Industrial Management Proposed for Colleges

A course in management education, to provide a sufficient number of properly trained executives for the industries of the United States, is to be established in a majority of the 620 American colleges, according to an announcement made to the Associated Press by Dr. Hollis Godfrey, president of the Drexel Institute, Philadelphia, and former commissioner of the Advisory Commission of the Council of National Defense.

The plan, which is an outgrowth of a convention attended by representatives of industry and colleges in Philadelphia last March, is backed by corporations representing a capitalization of $26,000,000,000. It is the result, Doctor Godfrey said, of thes two factors coming to a definite working agreement for the first time through the establishment of the Council of Management Education, an organization formed "to study mutual problems in order that the colleges may render the greatest possible service to industry."

Students and Teachers in Industry

It is contemplated to establish practical courses in schools, and to assist undergraduates and others to choose their life's work, by placing several thousand students and teachers in industry during the summer months and by introducing extension courses for men now in industry. Doctor Godfrey is being assisted in the perfection of his plan by Doctor Samuel T. Chapen, general director of the American Council on Education, representing the 620 colleges and Dr. Frederick C. Ferry, president of Hamilton College.

An annual appropriation of $100,000, entirely borne by American industry, has been made to carry on the work of the Council of Management Education. Part of this money will be devoted to a determination of the extent of field service that each college can cover and part to provide the colleges with all industrial data which may be utilized in forming undergraduate courses, within one year, it is estimated, 100 colleges will have included the extension industrial courses and all will be provided with the industrial material upon which to base undergraduate work. The establishment of industrial executive training courses in colleges will do much, it is estimated, toward the re-establishment of industrial needs—increased production, decreased cost, increased stability, and increased incentive in industry.

The executive members of the council, appointed to represent their industrial groups, are as follows: Railroads, A. W. Gibbs, chief mechanical engineer, Pennsylvania R.R.; paper, Colonel B. A. Franklin, vice-president Strathmore Paper Co.; public utilities, H. B. Shaw, educational director, H. L. Doherty Co.; shoes and leather, Frederick B. Rice, president, Rice & Hutchins; mining, J. Park Channing, mining engineer; machinery and metals, Frederick H. Payne, Greenfield Tap and Die Co.; rubber, Dr. R. S. Quinby, service manager, Hood Rubber Co.; cotton finishing, J. K. Milliken, president, Mt. Hope Finishing Co.; textiles, Albert Bigelow, Ludlow Manufacturing Co.

Educational Group

The educational group includes, besides Dr. Godfrey and Dr. Capen, Dr. Frank Graves, dean of the school of education, University of Pennsylvania; Dr. Charles Tilden, professor of engineering mechanics, Yale University; Dr. David Tennant, professor of biology, Bryn Mawr, College; Dr. Leigh Reid, professor of mathematics, Haverford College; C. L. Evanson, professor of engineering administration, Drexel Institute, and J. S. Pearson, professor, Drexel Institute.

The American Council on Education has appointed the following committee as a permanent body to co-operate with the Council of Management Education:

Dr. Capen, chairman; Dr. Charles R. Mann, chairman of the advisory board, educational training of the general staff, War Department; Frederick L. Bishop, dean, engineering school, University of Pittsburgh; Park R. Kilbe, president, Municipal University of Akron; Raymond Hughes, president Miami University.

Pennsylvania R.R. Awards Maintenance Prizes

On the completion this week of the first day's inspection of the main line of the Pennsylvania R.R., Easton region, General Manager C. S. Krick awarded the track maintenance prizes to the supervisors and their assistants who have made the best maintenance record. The first or "Klondyke" prize, amounting to $800 for the supervisor and $400 for the assistant, awarded for maintaining the best section of track throughout the past year, was presented to H. H. Mauffman, supervisor, and J. B. Otto, Jr., assistant supervisor, who have charge of the track between Dillerville, Pa., and Harrisburg. The three other prizes were premiums of $800 each, of which $600 was for the supervisor and $200 for the assistant, for the best line and surface on a main line between New York and Washington, and Philadelphia and Altoona. The prize sections include the track between Elizabeth, N. J., and Plainsboro, N. J.; between Marysville, Pa., and Durward, Pa.; and between Baltimore and Washington. A special improvement premium, $1,000, for having shown the greatest improvement in line and surface was awarded to the supervisor and assistant supervisor for track from 62d St., Philadelphia, to Wilmington.

The awards are made on the basis of inspection by a committee of officers which goes over the line in a special car carrying the instrument to register riding qualities of track.

Oklahoma Engineering Council To Be Formed

At Tulsa, Okla., Oct. 26 and 27, the legislative committees and ways and means committees of the Oklahoma Society of Engineers, the three chapters of the American Association of Engineers, the Oklahoma Section, Am. Soc. C. E., the A. S. M. E. and A. I. M. E. and including also similar committees from the Oklahoma Chapter of the General Contractors of America will meet and organize the Oklahoma State and Engineering Council. A large portion of both days will be devoted to a discussion of proposed legislative enactments covering salaries of engineers in the highway and sanitary state service, reducing the multiplicity of utility reports, amending the special assessments paving law, etc.

The main visiting speakers will be M. O. Leighton, Washington, D. C., F. H. Newell, Phoenix, Ariz., and L. K. Sherman, Chicago, Ill.

Water Power League Meets

That water power matters are coming in for very general study was indicated by the discussions which took place at the convention of the Water Power League of America, which was held in Washington Oct. 7 and 8. When it is considered that the organization is a new one, and that its purposes and policies were not generally known, the attendance was very good. The keen interest in the matters discussed in the addresses was indicated by the live character of the general discussions. Dr. George F. Swain, professor of civil engineering at Harvard University, who accepted the presidency of the Water Power League just prior to the meeting, presided at all of the sessions. As a result of the encouragement given the organization, at the convention, committees are to be appointed to consider various of the problems facing water power development and a Washington office of the League is to be opened.

Commerce Commission Begins Work on Rail Merger Plan

Work has been begun by the Interstate Commerce Commission in preparing a tentative plan for the merging of railroad companies into a limited number of competing systems in accordance with the terms of the Transportation Act. Such mergers, under the terms of the Transportation Act, are permissive and not obligatory to the carriers concerned. The commission has retained Prof. William Z. Ripley, of Harvard University, to assist in working out such a plan. Plans which have been worked out by various interests and individuals will be collected and examined.

When the railroad bills went to conference last December the Senate provision for compulsory consolidation was superseded by that finally adopted for permissive mergers, with the direction to the commissison that it should prepare and adopt a plan for the railway properties of the continental United States into a limited number of systems so organized that competition will be preserved and existing channels of traffic maintained.

After the plan for mergers is complete it will be made public and notice filed with the governors of the states concerned, after which the commission will hear persons who file objections to the plan.

New York City Buys 100 Tractors for Snow Removal

As a result of tests of equipment for snow removal, conducted recently, the City of New York has purchased from the Cleveland Tractor Co. 100 small tank-type tractors fitted with winter tracks and covered cabs with two-man seats. Delivery of the "Cletrac" machines to the Department of Street Cleaning is scheduled for December.

River and Harbor Board on Pacific Coast

The Board of Engineers for Rivers and Harbors is making an inspection tour of the principal projects on the Pacific Coast. A public hearing was held October 6 at Lewiston, Idaho, in connection with the improvements on that section of the Columbia River authorized in the 1916 River and Harbor Act. The whole matter of navigation, irrigation and power development will be inquired into. From Lewiston the Board went down the Snake River and the Columbia by boat so as to be able to visualize the territory involved. An inspection also was made of the Columbia River from its mouth to Portland so that a more intelligent decision may be made as to the best plan for improving the channel. Coos Bay, where it is proposed to better the channel, and Gray's Harbor also were visited.

The Board of Engineers for Rivers and Harbors is composed of the following engineer officers: Brig.-Gen. Harry Taylor, Col. James C. Sanford, Col. Charles Keller, Col. William Ladue, Col. John C. Oakes, Major Max C. Tyler, and Major C. S. Ridley.

To Confer on Employment

A conference on employment and education, sponsored by the American Association of Engineers, will be held in the Congress Hotel, Chicago, Nov. 12. The purpose of the meeting is to consider the general problems of employment.

The session will begin at 9 a.m. and after several subjects have been discussed will divide into four group meetings at about 11 a.m., as follows: (1) Employers and employment managers; (2) managers or representatives of free employment bureaus; (3) representatives of educational institutions and (4) those not in any of the three other groups.

The groups will be considered after luncheon into an afternon session and an evening session.

More Money For Federal Study of Road Problems Indicated

(Washington Correspondence)

It is believed that public insistence has reached a point where Congress will provide adequate money for the economic study of problems arising from the construction of highways. The possibility that such action will be taken is greater because all of the Congressmen have been at home long enough to come in close touch with the desires of their constituents. One of the economic studies which is being insisted upon would look to the development of a system of road management which would insure that funds are expended on the most essential roads and on such types of improvement as will meet the traffic needs. In this connection it is believed to be essential that data be assembled as to the character and amount of traffic passing over the various types of road.

The shortage of transportation and the increase in freight rates have given rise to a demand that information as to the availability of local material be obtained. It is generally accepted that local materials could be used to a much greater extent than they are, but the individual localities, as a rule, are not in a position to undertake this type of study. It is urged that this be done by the Federal Government since it could take advantage of experience and practice throughout the country. Such a study would include proportions of concrete, types of aggregates, the use of blast furnace slag, and the properties of the various kinds of local stone.

In addition, there is an insistent demand for research in matters concerning drainage, impact, and subgrades. Studies already have been instituted by the Bureau of Public Roads to determine which types of soils have high bearing value and how soils of low bearing value can be improved.

Incidentally the users of the highways are beginning to take account of haulage costs. They are beginning to ask how much certain grades add to gasoline consumption. They want to know the effect of the various types of surface on tire wear. There are no comprehensive data on such subjects and it is being asked that the Bureau of Public Roads, which is in a position to make the most effective study of such questions, be given the money necessary to conduct them.

Harrisburg Engineers May Combine With Laymen's Club

After meetings between a joint committee of the Engineers' Society of Pennsylvania, the Harrisburg Club, and the University Club of that city, a resolution was passed voting that the question be submitted to the membership for combining the quarters of these three organizations. It has been felt that additional room and facilities were needed by each, but that it would not be feasible for the individual organizations to undertake expansion separately.

A. S. M. E. to Hold Keynote Session on Transportation

The tentative program which has been prepared for the annual meeting of the American Society of Mechanical Engineers at the Engineering Societies Building, New York City, Dec. 7-10, 1920, includes a "Keynote Session on Transportation," at which various phases of the transportation problem, including railroads, waterways, feeders, motor trucks, and the terminal problems in New York City will be discussed by authorities in these fields.

The sessions of professional sections will include fuels, machine shop, management, railroad, textile, power, woodworking, research, design, and miscellaneous subjects. At the fuels session L. P. Breckenridge will speak on the "Fuel Supply of the World," and the management session will be devoted to the life and work of the late Henry L Gantt. The following speakers and subjects are scheduled for the railroad session: "Static Adjustment of Trucks on Curves," by R. Eksergian; "Increasing Capacity of Old Locomotives," by C. B. Smith, and "Modernizing Locomotive Terminals," by George W. Rink. The power session will be devoted to consideration of the future development of power. At the research session D. E. Foster is scheduled to speak on "The Flow of Fluids Through Pipe Lines, and the Effect of Pipe Line Fittings." N. W. Akimoff will speak on "Foundations for Machinery" at the design session.

Engineer Registration Board Named in Virginia

Members of the state board for the examination and certification of architects, professional engineers and land surveyors, approved on March 19, 1920, have been named by the Governor of Virginia, as follows: P. B. Winfree, engineer, Lynchburg; James F. MacTier, engineer, Roanoke; John Kevan Peebles, architect, Norfolk; Fiske Kimball, architect, University of Virginia; W. C. Noland, architect, Richmond; Thomas M. Fendall, surveyor, Leesburg; L. B. Dutrow, surveyor, Peyersburg; W. D. Tyler, engineer, Dante; C. G. Massie, Amherst.

Reserve Board Finds No Signs of Housing Shortage Relief

In reviewing the general business conditions during September, the Federal Reserve Board has the following to say in regard to construction activities:

The housing shortage continues to be acute in the principal cities. In New York the bulk of the new building is on contracts executed last spring or late in the winter. However, building at prevailing prices has reached or passed its peak. There has been continued wrecking of houses to be supplanted by business buildings. For August, 1,010 contracts were awarded in New York and northern New Jersey, the valuation of which was $38,000,000, as against $36,000,000 in July. In Chicago easing is noted in the building trades. Building enterprises all through the Chicago district are still practically at a standstill. Net costs of building are now 15 to 20 per cent lower than they were a month ago. On the Pacific Coast there was a falling off in building permits from $15,582,000 in July to $13,526,000 for August, but the number of permits issued was larger. The failure to build more freely is still assigned to the high costs of building which are estimated at from two to four times pre-war costs.

Austrian Engineers To Receive American Food Drafts

Engineers and architects of Austria are to participate in the distribution of food drafts, for the payment of which a special fund has been created by the Commonwealth Fund of New York, a private American institution established for the promotion of intellectual development throughout the world. The Commonwealth Fund has provided for food distribution among Austrian intellectuals upon a considerable scale, and engineers and architects who have completed high school training may, if their cases are worthy, secure food drafts, which are drawn in $10 amounts.

Various technical societies in Austria have assumed the responsibility of collecting applications for drafts. The *Journal* of the Austrian Society of Engineers and Architects, in its issue of Aug. 6, carried a half-page notice of the Commonwealth Fund offer pasted upon the front cover. To participate in the food distribution applicants must prove their circumstances extenuating from considerations of sickness, accident, indebtedness, etc.

Construction Service Projects

Projects about to be undertaken by the Construction Service of the Army are as follows: Transmission lines at Muscle Shoals; quartermaster storehouse at Fort Ruger, Hawaii; passenger waiting room, army supply base, Boston; seventy-five foot brick smokestack for hydrogen plant, Langley Field, Virginia.

Aërial Maps on Exhibition

An exhibit of aerial maps was made this month at the offices of the Corps of Engineers in Washington, D. C. The maps were so displayed as to make possible ready comparisons between regular topographic maps and the revised map made from the flyer's mosaic. Several of the Government's map-making agencies contributed to the exhibit. The exhibit was prepared for the meeting on Sept. 14 of the Board of Surveys and Maps. The maps were prepared for presentation by a committee headed by Major E. H. Marks, Corps of Engineers.

A. A. E. Chapters Planning for Club Houses

An option on a $40,000 four-story brick residence in Baltimore has been taken by a collateral corporation to the local chapter of the American Association of Engineers. The first floor would be rented for offices, the second occupied by the chapter and the other two floors would be rented as bachelor quarters to members.

The St. Louis chapter has similar plans but in addition would utilize much of the space for a graduate school for older engineers and elementary courses for younger members.

Activities of the A. A. E.

The Ann Arbor Chapter, at its opening fall meeting, Oct. 7, was addressed by Gardner S. Williams, consulting engineer, on "The Power Possibilities of the Great Lakes-St. Lawrence Waterway." James S. Bowman of the Fargo Engineering Co., Jackson, Mich., spoke on the need for greater restriction in the development of power in our National Parks. The officers of this chapter for the remainder of the year are: President, G. H. Cissel; vice-president, L. E. Ayers; secretary, Robert Norris; treasurer, George Sandenberg.

The Dunsmuir (Cal.) Chapter has recently been organized with the following officers: President, L. H. Taylor; first vice-president, G. M. Taylor; second vice-president, V. E. Parker; secretary-treasurer, J. G. Standley.

The San Francisco Chapter has organized an employment bureau with headquarters in the Pacific Building.

After a conference between representatives of the federal department of American Association of Engineers, the Navy Labor Board and Secretary Daniels, an increase of 72c. per day was granted Oct. 1 to the navy technical force not receiving the bonus of $240 per year. This is in addition to the recent salary award of the Navy Labor Board of 5 per cent which had a net effect of more than 1 per cent decrease on account of the establishment of Saturday half-holidays.

Civil Service Examination United States

For the United States Civil Service examinations listed below apply to the United States Civil Service Commission, Washington, D. C.

Senior Civil Engineer, Grade 2, $2,100 to $2,700 a year. Applications will be received until further notice.

Highway Engineer, Bureau of Public Roads, $2,400 to $3,000 a year. Applications received until Dec. 28.

Canada

Application forms may be obtained from the Employment Service of Canada or from the Secretary of the Civil Service Commission, Ottawa.

Junior Engineer, $1,680 to $2,040 a year. File application not later than Oct. 28.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN RAILWAY BRIDGE & BUILDING ASSOCIATION, Chicago; Atlanta, Ga., Oct. 26-28.

NATIONAL DRAINAGE CONGRESS, Chicago; Atlanta, Ga., Nov. 10-12.

The Brooklyn Engineers' Club announces the following meetings: Nov. 4, "The German Long Range Gun" by Lt.-Col. H. W. Miller in an illustrated lecture; Nov. 11, "City Planning for the Borough of Queens" by Charles Powell; Nov 18, "Industrial Brooklyn, Paper No. 2" by Walter Pfaendler, engineer for E. W. Bliss Co.; Dec. 2, informal talk by E. C. Wilder, New York Edison Co.; Dec. 9, annual meeting and election of officers.

Engineering Institute of Canada. A local branch was organized at Moncton, N. B., Oct. 11. After an address by Fraser S. Keith of Montreal, secretary of the Institute, officers of the local branch were elected as follows: W. A. Duff, chairman; J. D. McBeath, vice-chairman; M. J. Murphy, secretary-treasurer. Committee: Reid McManus, R. G. Gage, J. E. Dington, F. B. Fripp, S. B. Wass and H. J. Grudge.

The Rochester Engineering Society at its meeting Oct. 8 was addressed by Dr. W. H. Souder of the Bureau of Standards on the advantages and disadvantages of the metric system of weights and measures.

The Oklahoma Highway Engineers' Association, at a meeting held at Oklahoma City, elected the following officers: Will M. Clarke, of Pawhuska, president; Pearl Little, first vice-president; Floyd Frazier McAlester, second vice-president; Frank Herrmann, secretary-treasurer.

PERSONAL NOTES

MALCOLM ELLIOT, who served as an engineer officer in the National Army and who recently has been employed as a civilian engineer on the work at the Wilson dam, has accepted a commission as major.

L. G. CARPENTER, engineer, has been employed by the San Diego, Cal., water commission to furnish plans and estimates for converting Dulzura Creek into a conduit to convey the city water supply from Dulzura to Lower Otay.

J. M. BARDE, highway engineer, has been employed by the Carthage, Mo., Special Road District to supervise the construction work on the Carthage section of the Carthage-Carterville concrete road.

STEVENS & KOON is a new firm of consulting engineers organized by J. C. Stevens and R. E. Koon with offices in the Spalding Building, Portland, Oregon.

CLARENCE K. WHITING has resigned as engineer for the Kent County, Michigan, road commission to engage in the contracting business.

J. H. SCOTT has been appointed divisional engineer for the state highway commission, The Dalles, Oregon.

NATHAN I. KASS, recently connected with Hill & Ferguson, consulting engineers, New York City, in the capacity of assistant engineer and chief draftsman, has joined the organization of Redler, Inc., printers and lithographers. It is the intention of Mr. Kass to continue serving the engineering profession by specializing in technical printing.

J. J. MCCABE has been appointed general superintendent of a dam at Decatur, Ill., to succeed Bradley Johnson, resigned.

LT.-COL. L. L. CALVERT, formerly in charge of the construction division of the Construction Service, U. S. Army, has resumed his pre-war position as chief engineer with the Tidewater Building Company, New York.

C. B. BROWN, chief engineer, Canadian National R.R., Moncton, N. B., has been appointed engineering assistant with headquarters at Toronto.

A. F. STEWART, chief engineer, Canadian National R.R., Toronto, has been appointed chief engineer of the company at Moncton, N. B.

H. T. HAZEN, engineer maintenance of way, Canadian National R.R., Toronto, has been appointed chief engineer.

FRANK BIDWELL, assistant engineer, Public Service Railway Co., Orange, N. J., has been appointed executive secretary to the state highway engineer, Thomas J. Wasser.

D. GORDON CALVERT, recently with the Procter & Gamble Co. of Cincinnati, Ohio, on their plant extensions, including a $3,000,000 plant at Dallas, Tex., has been appointed resident engineer in charge of the construction and equipment of the plant of the Fort William Paper Co. at Fort William, Ont., Canada.

J. R. ALLEN of Pittsburgh, Pa., formerly dean of the engineering school, University of Minnesota, and director of the research laboratories, American Society of Heating and Ventilating Engineers, has been appointed consulting engineer on ventilation to the chief engineer of the New York and New Jersey commissions in charge of the construction of the Hudson River vehicular tunnels.

WILLIAM SNAITH has resigned as assistant engineer in the office of Barber, Wynne-Roberts & Seymour to accept the position of chief draftsman for the Riordan Pulp & Paper Co., Ltd., at Mattawa, Canada.

J. M. BEGG, formerly assistant city engineer, Edmonton, has been appointed city engineer of Brandon, Man., Canada.

A. M. GREEN has been appointed engineer of Modoc County, Cal.

H. PRESS SMITH has been elected engineer of Sonoma County Cal., to succeed Lloyd Aldrich, resigned.

L. E. LYON, a civilian member of the Army engineer staff in the Norfolk district, has been commissioned a major.

W. H. LANAGAN has accepted a commission as major of engineers and has been assigned to the Fifth Regiment at Camp Humphreys.

OBITUARY

HON. W. F. AYLMER, for many years Dominion Engineer in the Kootenay and Revelstoke districts, Canada, died Sept. 22 at Chase, B. C.

ARTHUR C. WHEATLEY, well known in Mexico, where he has been engaged in railroad location and construction at Santa Barbara for the American Smelting & Refining Co., died Sept. 24 at El Paso, Tex. Mr. Wheatley was formerly engaged in railroad surveys for the Mexican Pacific Ry., the Central American Ry., and for railways in Africa.

ERNEST G. HENDERSON, civil engineer, Windsor, Ont., Canada, died on Oct. 13. For a number of years he was engaged in construction work for the Canadian Pacific Railway. Later he became manager and, more recently, president of the Canadian Salt Works, Windsor. Mr. Henderson served a term as president of the Canadian Manufacturers' Association.

MAJOR WILLIAM A. CATTELL, during the war in charge at Washington, D. C., of the historical data section, Office of the Chief Engineers, U. S. Army, died on Oct. 10 of heart failure and complications. Since leaving his work with the War Department Major Cattell has lived at Alhambra, Cal., and although he was not in good health the sudden end was unexpected. Previous to the war, Major Cattell was in consulting engineering practice for many years in San Francisco. During that time he was identified with many important projects and attained a prominent place in engineering circles. He was at one time president of the San Francisco Section, American Society of Civil Engineers. He became widely known in 1915 through his effective service as secretary-treasurer of the International Engineering Congress.